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Integrated Riparian Evaluation Guide

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INTEGRATED RIPARIAN EVALUATION GUIDE

INTERMOUNTAIN REGION

March 1992

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Chapter 1 - OVERVIEW

Chapter 1. OVERVIEW

Riparian areas consist of riparian ecosystems, aquatic ecosystems, and wetlands. They may be associated with lakes, reservoirs, estuaries, potholes, marshes, springs, bogs, wet meadows, and intermittent or perennial streams where free and unbound water is available. Though riparian areas constitute only a fraction of the total land area, they are more productive in terms of both plant and animal species diversity and biomass per unit area than the remainder of the land base. Riparian areas are extremely important for flood control and hydrologic function (water quantity, quality, and timing). Recognition of riparian-dependent resource values and their potential is essential to good riparian management. It is important to recognize that not all riparian areas have the same potential or react to management in the same way and, therefore, should not be managed the same.

To understand riparian areas and the processes occurring within them, an understanding of the entire landscape and the total watershed is necessary. The kind of watershed system will influence, and in some cases directly relate to, the kind of riparian factors present. For example, if a watershed is located at high elevations and receives heavy snow pack during the winter, it will exhibit a suite of characteristics different from a watershed which is located at lower elevations with low snow pack. Watersheds with lakes in the stream systems will have stream dynamics unique to that kind of system and will produce riparian areas with different characteristics than those without lakes. Land characters outside of the riparian area such as soil materials or the geomorphology of the watershed can directly influence the functioning of riparian areas.

The sociological and economic importance of the riparian zone is generally recognized within the Forest Service; however, an interdisciplinary systematic approach to riparian evaluation and classification has been lacking. The procedures described in this guide require an integrated approach. The best results are achieved when interdisciplinary team (ID) members work together. This fosters a common understanding and unified recommendations for problem solving.

It has long been the goal of those who work in riparian areas to define and understand the physical nature and processes of these complex ecosystems. Often our approach to solving riparian problems has been to install various structures or change management. While some practices have produced good results, others have been failures. Traditionally, resource managers have lacked the skills and knowledge to interpret success or failure. They need to know which practices will work in a wide variety of riparian systems which have different potentials.

This guide provides an integrated approach for:

A. Stratifying and classifying riparian areas according to their natural inherent characteristics, and their respective existing or conditions.

B. Data collection.

C. Evaluation of riparian areas.

D. Future development and linkage of a riparian data base.

E. Preparation of a written narrative to interpret the data and suggest management applications.

F. Providing a process to prioritize or rank riparian areas based on management objectives.

G. Strengthening the riparian management implications of the Forest Land Management Plan.

DESCRIPTION AND SELECTION OF INTENSITY LEVELS

This Guide outlines three "levels" of evaluation. It is important that the user understands the interrelationship of these levels. It also outlines the process for gathering information for each level through an interdisciplinary approach. The Guide allows the user to proceed to the level of specificity needed for any area. The process is designed to be cumulative. Each level builds on the previous level and provides a basic framework of knowledge about a given riparian area. For any given project level activity, Level I must be completed before Level II, and Level II is a prerequisite for Level III.

The objectives, procedures, and applications are discussed for each level of inventory.

Level I

Level I is an office procedure that begins by assembling and interpreting existing maps, data, and Forest Plan direction. This process results in three products: (1) a delineation of riparian sub-areas; (2) identification of management categories; and (3) a prioritized list of riparian areas for which more detailed information is required. Sub-area delineation is based on geomorphic landform, parent material, stream gradient, and other factors, including observable, repeating riparian vegetation patterns. Management categories summarize the desired conditions, or measurable objectives, for the riparian sub-areas. These management categories are generally based on the type and value of riparian-dependent resources associated with the sub-area and the vulnerability of these dependent resources to disturbance. Comparison of preliminary information on existing condition to the desired condition will suggest priorities for conducting Level II inventories.

Level II

Level II is a field procedure that identifies and maps the boundaries of "riparian complexes." Riparian complexes are the basic units for which interpretations are developed and by which information is extrapolated. They represent units of land with a given biotic and abiotic potential based on the geomorphology, landform, soil, stream gradient, elevation, and vegetation. Riparian complexes are delineated on the basis of field observations and may correspond to or be subdivisions of the sub-areas identified at Level I.

Level III

Level III involves more intensive, site-specific field data collection to address specific questions, issues, or needs. Quantitative data are collected to: (1) characterize existing and potential riparian complex conditions; and (2) to monitor changes in those conditions. Information from Level III surveys is used to assess impacts of management activities make adjustments in management practices, and for "project planning and design."

The various levels of riparian evaluation are displayed and characterized in Figure 1.

FIGURE 1: RIPARIAN AREA EVALUATION SUMMARY

EVALUATION LEVEL	KINDS OF DATA	MANAGEMENT APPLICATIONS
LEVEL I Extensive Office procedure I.D. Team Management Team Existing data	Existing or estimated: a. Stream type (Rosgen) b. Cover types c. Geomorphology/geology d. Available soil maps e. Topographic maps f. Aspect and elevation g. Wildlife and fish species presence h. Land use	a. Documents existing information b. Displays riparian-dependant resource values and management categories c. Results in a map of riparian sub-areas d. Provides basis for prioritization for higher level evaluation (II or III) e. Can result in establishing management goals f. Can provide some indication of riparian health g. Wildlife and fisheries species implications
LEVEL II Extensive field work ID Team New data	Field validate: a. Stream type (Rosgen) b. Valley bottom type c. Vegetation community type composition estimated d. Wildlife and fisheries habitat relationships e. Assess aquatic habitat f. Soil families and percent composition (no soil map) g. Area extent of riparian area h. Land-use activities and estimated influences i. Bank stability (field estimate) j. Geomorphology/Geology	a. Identifies and maps riparian complexes b. Verifies riparian-dependent resource values c. Characterizes existing riparian status in relation to potential d. Identifies areas for Level III evaluation e. Evaluates current management effect f. Allows extrapolation of management experiences to similar areas g. Evaluate appropriateness of standards and guides h. Provides a basis for management decisions i. Verifies geology, geomorphology and dominant soil families j. Assess effects of natural process and management impacts

FIGURE 1: RIPARIAN AREA EVALUATION SUMMARY (cont.)

EVALUATION LEVEL	KINDS OF DATA	MANAGEMENT APPLICATIONS
LEVEL III Site specific I.D. Team Intensive field work	a. Foliage height/volume b. Vegetation community type and composition c. Quantity of aquatic habitat d. Order 1 or 2 soil map and soils interpretation e. Woody species regeneration f. Stream type/channel morphology	a. Monitoring procedure b. Characterizes the riparian complexes c. Refines the relationship between natural processes and management implications d. Quantifies current status/ potential e. Quantifies/validates riparian -dependent resource values f. Identifies factors limiting achievement of riparian potential or management goals. g. Provides detailed project design criteria based on site characteristics h. Quantitatively validates standards and guidelines

Chapter 2 - LEVEL I RIPARIAN AREA EVALUATION

Chapter 2. LEVEL I RIPARIAN AREA EVALUATION

A. Objectives

1. Assemble existing riparian information, data, or inventories. Some initial judgement of existing riparian area condition or status may be used in addition to the existing inventories.

2. Provide a map showing riparian distribution and extent, stratified by sub-area.

3. Provide a Forest-wide prioritization for evaluating riparian areas.

4. Develop ownership of, and commitment to, riparian evaluation through the involvement of an ID Team and the Forest Management Team.

5. Provide a useful tool for communication both internally and with the public.

6. Display and document the basis for riparian resource value ratings.

B. Procedures

Assemble all the available riparian-related information and data to complete the Level I form. Some of the existing data or information available may be derived from the following: Land Resource Management Plan, topographic quadrangle maps, range analysis inventory, soil resource inventory, timber inventories, fish/wildlife surveys, water resource inventories, geology or geomorphic information, aerial photos, and other pertinent information relative to riparian stratification. The amount and detail of existing data will vary by area. Local knowledge from people who have worked in the geographic area or are familiar with the area, is a resource which should not be overlooked. *Where data are lacking, these portions should be left blank, avoiding guesses that may bias evaluation.*

1. Delineation of sub-areas

Using aerial photographs and topographic maps, delineate the riparian areas into reaches of similar character. These reaches are called sub-areas and are based on observable differences and/or similarities in geology, geomorphology, fluvial processes, vegetation, stream sinuosity and confinement, or stream entrenchment. Aspect, elevation, gradient, and valley bottom type are best determined from topographic maps and aerial photos. These riparian sub-areas are transferred to a quad (1:24,000) map which serves as the base map for Level I. Each riparian sub-area is given a name and identification number. Estimate riparian condition for each riparian sub-area, if information exists from stream channel surveys, aquatic surveys, and/or existing inventories.

C. Analysis

Level I produces a base map showing the location of riparian sub-area boundaries. The sub-areas are given a unique identification number that will be tracked through the other riparian evaluation levels.

The information known about each sub-area or group of sub-areas is used to direct the field evaluation in Levels II and III. A short narrative and the Level I form provides necessary documentation of the process. Using data from the Level I riparian evaluation, riparian sub-areas can be stratified into Forest-specific management categories, which are based on riparian-dependent resource values. These provide the basis for continuing or not continuing to Level II.

Level I may also produce a map displaying the Riparian Management Categories, by stream, for the Forest. This gives each unit a visualization of the specific management direction that applies to a riparian area.

The following two processes are important steps needing completion at Level I. Categorization and prioritization may have occurred prior to formalizing riparian evaluation and completing Level I. If so, all that is required in Level I is to document the information.

1. **Categorization**

A riparian management category classification should be made for each Forest if this was not done during forest plan development. The purpose of the classification is to define management emphasis (or needed protection) based primarily on riparian-dependent values. Examples of riparian-dependent values include: fisheries, wildlife, recreation, threatened and endangered or sensitive plants and animals, water quality, or others. This is an interdisciplinary process and should involve the Forest Management Team and ID Team. An example of a classification system used on the Sawtooth NF is shown in Appendix B. A form documenting the classification criteria and weight factors for the Uinta NF is shown in Appendix C. These forms illustrate methods that individual Forests might use to document their classification systems.

Once the riparian management categories have been developed (such as in Appendices B and C), goals can be prepared for each category to reflect desired condition. Goal setting can usually be done following the Level I review of existing data. Goal setting by describing the desired condition is a joint effort of the Management Team and ID Team. The goals set in developing riparian management categories may involve an amendment to forest plans and be used as minimum management requirement of forest plan goals and objectives (or standards and guidelines). Goals should be written that establish a desired measurable condition for each value and environmental component within management categories.

2. **Prioritization**

Separate from the riparian categorization is the need to prioritize individual riparian sub-areas for further inventory and management action. The riparian data form for Level I contains items that can be used in the prioritization process for future management activities. A rating system can be developed similar to the Uinta classification system (Appendix C), incorporating existing riparian condition and riparian-dependent resource values as criteria. Where categorization might apply to an entire stream or watershed, prioritization would normally apply to a sub-area of the stream or watershed. For example, this situation applies to the development of allotment management plans where a stream with high value passes through two allotments--the first in good to excellent condition, and the second needing improvement. Priority for management action would apply to the second allotment even though management emphasis is high for both.

Some priority should be given to evaluating riparian areas in good to excellent condition to provide reference or baseline information to identify potential for riparian areas needing improvement.

D. Level I Riparian Data Sheet (example sheets follow).

RIPARIAN DATA SHEET (Level I)

Date: _____/_____/_____

Subarea ID _____

Riparian Management Category _____ NFS Watershed No. _____

Name _____ Quad Name / No. _____

ENVIRONMENTAL / GEOMORPHIC SETTING

_____Lacustrine (lakes, ponds, reservoir) _____Riverine (streams, rivers, etc.)

_____Meadow _____Other (seeps, bogs, etc.)

Specify: _____

Remarks _____

_____

_____

PHYSICAL LANDSCAPE

Geologic Parent Material _____ Valley Bottom Type _____

Aspect Elevation Range _____ _____

Lower Upper

Size: Length _____Miles Area _____Acres

Landform Characteristics _____

_____

Soil Map Unit Nos. _____

RIVERINE GEOMORPHOLOGY (if applicable)

Stream Order _____ Sinuosity _____ Gradient _____%

Dominant Substrate _____ Stream Type (Rosgen) 1985_____ 1991_____

DOMINANT RIPARIAN VEGETATION (check one)

_____Conifer _____Deciduous _____Shrub _____Herb / Graminoid _____Non-vegetated

Remarks _____

_____

_____

RESOURCE RATINGS (Level I)

	CONDITION	VALUE CLASS	SENSITIVITY
Riparian Components			
Vegetation Source / Basis	_____ _____	_____ _____	_____ _____
Soil Source / Basis	_____ _____	_____ _____	_____ _____
Water Quality Source / Basis	_____ _____	_____ _____	_____ _____
Other Source / Basis	_____ _____	_____ _____	_____ _____
Habitat			
Fisheries Source / Basis	_____ _____	_____ _____	_____ _____
Wildlife Source / Basis	_____ _____	_____ _____	_____ _____
Other (specific species) Source / Basis	_____ _____	_____ _____	_____ _____
Other (specific species) Source / Basis	_____ _____	_____ _____	_____ _____
Uses			
Recreation Source / Basis		_____ _____	_____ _____
Administrative Designation Specify Designation		_____ _____	
Livestock Source / Basis		_____ _____	_____ _____
Other (specify) Source / Basis		_____ _____	_____ _____
Other (specify) Source / Basis		_____ _____	_____ _____

Remarks _____

_____

_____

_____

E. Instructions for Completing Level I Riparian Data Sheet

Only known information and/or credible estimates will be entered on the form. Leave the space blank if information is unknown or not reliable.

Sub-area ID

Enter a nine-digit code that identifies the stream reach. Enter, in order, a one-digit Region code, a two digit Forest code, a two digit District code, and a four-digit sub-area code (example, Appendix G).

Riparian Management Category

Enter the Riparian Management Category code if the Forest has developed a system. The reverse side of this form is used to document the resource information used to determine the category designation.

NFS Watershed No.

Enter the three-digit NFS watershed number. (Reference: Water Use Requirements and Rights Inventory Technical Guide R-4, Sept. 1972, revised June 1978.)

Name

Enter name of stream, lake, reservoir, meadow, bog. etc.

Quad Name/No.

Enter name or number of the map on which the riparian sub-area is displayed. The 7.5 minute U.S. Geologic Survey Quadrangle should be used where available.

ENVIRONMENTAL/GEOMORPHIC SETTING

Check appropriate type. If it is more than one; i.e., stream through a meadow, check both. Note any unique information in remarks.

PHYSICAL LANDSCAPE

Geologic Parent Material

Use geologic maps specific to the area and the National Soil Handbook, part 607, to select correct term.

Valley Bottom Type

Enter four-digit valley bottom code (See Appendix D).

Aspect

Enter the aspect of valley floor direction looking downstream, or in case of meadows, bogs, lakes, etc., the aspect of the dominant drainage pattern. Use an eight point aspect system (i.e., N, NE, E, SE, S, SW, W, NW)

Elevation Range

Enter the elevations for the lower and upper boundaries of the sub-area.

Size

Enter the length of stream in miles or the area, in acres, of the riparian sub-area for non-stream settings. If the information exists, an estimate of the area of the riparian area for riverine settings can be made.

Landform Characteristics

Use the National Soil Handbook, part 607, to select the correct term. If none apply, briefly describe the landform features.

Soil Map Unit Nos.

Enter the soil map unit numbers and names that apply to the sub-area, if available.

RIVERINE GEOMORPHOLOGY

Stream Order

Use "Strahler, A. N., 1957 Quantitative Analysis of Watershed Geomorphology," publication to select the correct entry.

Sinuosity

Calculate and enter the appropriate figure, as described by Rosgen (see Appendix E).

Gradient

Calculate from the quad map the gradient, and enter here.

Dominant Substrate

Describe the dominant channel materials as bedrock, boulder, cobble, gravel, sand, or silt/clay. Refer to Rosgen for size class descriptions. Two descriptors may be used; i.e., gravel, and sand (see Appendix E).

Stream Type

Enter the code of the estimated stream type, as described by Rosgen designate classification used; i.e., 1985 or 1991 (see Appendix E).

DOMINANT RIPARIAN VEGETATION

Check the appropriate item that applies for the sub-area.

RESOURCE RATINGS (Level I)

This side of the form is provided for the user to document the known resource information associated with the sub-area. Rationale for condition assessments, management category determinations, and expected response to management activities can be documented here. *This information is recorded only as user considers appropriate.*

Condition/Value Class/Sensitivity

Enter an appropriate descriptor in the table for condition, riparian value class, and sensitivity, as appropriate and available (see examples in Appendix C). Criteria used should be specified in writing for future reference. Standard condition descriptors are excellent, good, fair, and poor. Enter the appropriate value class from the system previously developed on the Forest. Enter as high, moderate, or low, the inherent sensitivity or vulnerability of the sub-area to management influences/impacts.

Enter any additional factors that may be appropriate for the sub-area.

Source/Basis

Note the source of information or the basis for the entry. Condition may be determined from inventories, professional judgement, etc. The basis for the value class should be criteria in the classification system that places the sub-area in that value class, i.e., T&E species, unique recreation resource, etc. Sensitivity ratings may be derived from the parent material, low tolerant species, etc.

Remarks: Make any further comments as desired.

Chapter 3 - LEVEL II RIPARIAN AREA EVALUATION

Chapter 3. LEVEL II RIPARIAN AREA EVALUATION

A. Objectives

1. Identify and map riparian complexes, the basic mapping unit for riparian areas, in the field.

2. Assess and interpret the effects of current management on observed conditions of the riparian resources.

3. Provides for a general estimate of existing vegetation status, aquatic resource condition, channel stability, etc.

4. Provides a basis for identification of broad relationships between geomorphology, vegetation, wildlife and fisheries resources, and land-use activities.

5. Validates the presence of threatened, endangered, or sensitive species in the riparian area.

6. Acquire the minimum level of information needed to address most riparian issues and provides a basis for management decisions.

7. Provide a basis for directing more intensive field evaluation (Level III).

Riparian areas are ecologically more diverse than surrounding uplands. In these areas, Level II inventory may substitute for other methods (e.g., Range Analysis). Level II is used to evaluate riparian resources, to assess best management practices identified in Allotment Management Plans (AMP's), timber sale KV plans, fish and wildlife action plans, soil and water improvement plans, recreation development plans, etc.

B. Procedures

Riparian areas in need of additional information than obtained in Level I are selected for evaluation at this level. The field Interdisciplinary Team consists of, at a minimum, representatives of the following functions: fisheries, hydrology, range, soils, and wildlife. Combined District and Supervisor Office participation is desired.

Following is a summary list of steps in completing the evaluation:

1. Select subareas from Level I to be evaluated (based on Level I prioritization).

2. Review the subareas to be visited in the field using air photos and maps. Identify on the photos differences in geomorphology, landform, and major longitudinal vegetation changes in addition to changes or refinements in any other criteria previously used. These refinements will be used to delineate the boundaries of complexes.

3. Compare and adjust mapping lines for both subareas and complexes based on field observations. It is important to remember that ecotones exist between complexes. These transition areas must be avoided during sampling and not interpreted as different complexes.

4. Vegetation community types are characterized by traversing the complex, passing through representative community types. Observations should be made on the relative composition for the riparian complex. If there is a concern about the quality and compatibility of data then the data can be collected at the same intensity levels i.e., if aquatic data are measured, vegetation data may be measured using line intercept transects.

5. Aquatic community habitat features at Level II may be evaluated in one of three ways. They are described below in order of increasing "intensity" of effort.

Single Ocular Estimate: Using this approach, the biologist/hydrologist walks the entire length of stream within the riparian complex being evaluated, keeping mental notes or a "crib sheet" on the aquatic community habitat attributes listed on the Level II Riparian Aquatic Data Sheet. After viewing the stream within the complex, an estimate for each habitat attribute is entered in column 1 of the form. The estimate represents the average value for the attribute as it occurs over the entire riparian complex.

The single ocular estimate minimally meets the objectives of the Level II inventory at the lowest possible cost. Because of the "mental averaging" that must be done over relatively long stream distances, replicability between observers may be low. The method also provides little insight to the spatial variability of the various habitat attributes within the complex.

Representative Segment Estimate: After walking the stream length within the complex, select a stream segment that best represents aquatic/riparian conditions within the complex. (Typically this will be at the same location used by other members of the interdisciplinary evaluation team.) Randomly locate a starting point and then estimate aquatic community habitat attributes for five, contiguous, equal length sections of stream that encompass a total of at least one full meander cycle (approximately 5-7 times the length of the mean bankfull channel width). For example, if the meander cycle of the stream within the complex is 400 feet in length, habitat attributes would be assessed for five, 80-foot sections. The five contiguous sections constitute the "representative segment." Data for each section is entered in a column on the Level II Riparian Aquatic Data Sheet.

This method, because it considers only one meander cycle, provides little insight to the spatial variability of habitat attributes. This approach assumes that a short segment of stream truly represents stream conditions within the complex.

Multiple Sample Estimate: Using this approach, five, non-contiguous stream segments are sampled within the riparian complex. The starting point for each sample segment is usually predetermined using air photos. Each sample segment is at least as long as one full-stream meander cycle. Habitat attribute data are entered for each segment in a column on the Level II Riparian Aquatic Data Sheet. This method considers habitat features over five meander cycles and provides some insight to spatial variability of attributes within the complex.

6. Dominant soil families and percent composition are determined for each riparian complex using standard USDA procedures, but may not necessarily result in a soil map. Some preliminary assessment of soil condition, i.e., compaction, erosion, displacement, etc., is made.

7. Take photos depicting the vegetation and geomorphic setting. A photo(s) specifically showing the greenline and stream channel or waterbody are also recommended. The purpose of photographs is to visually display what is portrayed on the data sheets. A chalkboard or similar device is suggested for keying the data sheet to the photograph. The chalkboard should be part of the photo and contain legible information including complex code, District and Date. If the photos are to be used for monitoring, they should be taken from an established point that can be easily located at a future date. Note the photo point on the accompanying map or aerial photo.

8. Fill out, in the field, the Level II form for each complex in the subarea or area of concern. The front side of the form characterizes the terrestrial riparian area while the reverse side characterizes the aquatic area habitat. The ID team should assemble as a group and discuss the observations so that any comments can be made on the form prior to leaving a complex.

C. Analysis

Level II survey information is compiled into a narrative report by the ID team for the management unit. The narrative may cover a single complex or a number of complexes within an allotment or other management unit. The narrative includes management recommendations and identifies riparian areas where additional information is needed. This directs Level III evaluations.

The narrative report includes information on the current status and relative potential for management of riparian dependant resources. Things to consider are: terrestrial wildlife habitat, beaver habitat, waterfowl habitat, aquatic habitat, floodplain and channel function relative to water quality, soil condition, livestock forage, merchantable timber, and developed and undeveloped recreation.

The interdisciplinary team utilizes the information collected from the survey and professional judgment to make statements on:

1. Apparent trend and current condition of riparian vegetation, aquatic habitat, soil resource, and channel morphology.

2. Potential for riparian vegetation, aquatic habitat, channel morphology.

3. Management recommendations with resource implications such as initial estimates of trade-offs between grazing, timber, recreation and the riparian dependant resources.

4. Need for more detailed inventory, project design, and/or monitoring (Level III).

Details relating to application and interpretations of the riparian evaluation data are found in the Management Applications and Interpretation Chapter of this Guide. An example narrative report is in Appendix G.

RIPARIAN COMPLEX DATA SHEET (Level II)

Key ID: R___ FO___ D___ YR___ subarea_____ complex_____

COMPLEX NAME _____

Waterbody name _____

District _____ Date _____ Quad name or # _____

Geologic parent material _____ Aspect _____

Valley bottom type _____ Stream type (Rosgen) 1985_____ 1991_____ Stream gradient _____%

Elevation: downstream elevation _____ft. Upstream elevation _____ft. Mid elevation _____ft.

Size of complex: Length _____ft. Width _____ft. Area _____acres

Soil Family	% Comp	Compaction
_____	_____	Sl / Md / Sv
_____	_____	Sl / Md / Sv
_____	_____	Sl / Md / Sv

ADJACENT (non-riparian area) UPLAND VEGETATION; LOOKING DOWNSTREAM

Left _____ Right _____

VEGETATIVE DESCRIPTION; DOMINANCE BY COMMUNITY TYPES

c.t. name	% of complex	estimated potential c.t. name

Successional status: PNC_____ Late_____ Mid_____ Early_____ Very Early_____

Apparent forage trend _____

Estimated forage production _____lbs.

BEAVER # caches in active ponds _____ # active dams _____ # inactive dams _____

GREEN LINE (Hydric) _____% **PHOTO ID:** _____

LAND USE ACTIVITIES AND ESTIMATED INFLUENCE ON RIPARIAN AREA

LIVESTOCK S&G	LIVESTOCK C&H	MINING	TIMBER	ROADING	RECREATION	ORV	OTHER
____	____	_____	_____	_____	_____	_____	_____

SPECIES LIST

Trees

Shrubs

Graminoids

Forbs

RIPARIAN AQUATIC DATA SHEET (Level II)

Method: Single Ocular_____, Representative Segment_____, Multiple Sample_____

POOL ATTRIBUTES	1	2	3	4	5
% Area in pools					
% Pool area made up of pools >2' deep					
AQUATIC VEGETATION					
% Streambed with filamentous algae					
% Stream margin with rooted aquatic					
BANK TYPE AND VEGETATION OVERHANG: Ocular_____ Paced_____					
% Bank length undercut (<90°)					
% Bank length gently sloping (>135°)					
% Bank length with overhanging veg.					
BANK CONDITION: Ocular_____ Paced_____					
% Bank length vegetated, stable					
% Bank length unvegetated, stable					
% Bank length vegetated, unstable					
% Bank length unvegetated, unstable					
Average % Vegetated, Stable_____ Estimated Potential % Vegetated, Stable_____					
CHANNEL MORPHOLOGY (XXX.X feet or meters - circle unit of measure)					
Bankfull: width					
: max depth					
: shore depth (L/R)	/	/	/	/	/
: bankfull channel shape					
Water : width					
: max depth					
: shore depth (L/R)	/	/	/	/	/
: wetted channel shape					
SUBSTRATE COMPOSITION					
% Sand/Silt (< .1")					
% Coarse fines (> .1-.25")					
% Gravel (.25-3.0")					
% Rubble (> 3.0-6.0")					
% Cobble (> 6.0-12.0")					
% Boulder (> 12.0-36.0")					
% Lg. bldr./Bedrock (> 36.0")					
% EMBEDDEDNESS (Ocular estimate)					
Spawning habitat (glide, pool tailout)					
Food production areas (riffle)					
Rearing/overwintering (pool)					

PEBBLE COUNT WORK TABLE: # particles by size class	1	2	3	4	5
Sand/Silt (< .1")					
Coarse fines (> .1-.25")					
Gravel (> .25-3.0")					
Rubble (> 3.0-6.0")					
Cobble (> 6.0-12.0")					
Boulder (> 12.0-36.0")					
Lg. bldr./Bedrock (> 36.0")					

D. Instructions for Completing Level II Riparian Complex Data Sheet

Key ID.

Show standard code number for Region, Forest, District, Year, Subarea (from level I data), and the code number for this complex (Example: R 4 FO 14 D 02 YR 87 Subarea TROC complex TR8. This is eighth complex in Trout Creek).

Complex Name

This is a name or code based on the dominant riparian type (stream, lake, etc.) dominant soil family, stream type, and vegetation community type. In the future, a Regional coding system will be developed based on the above listed factors. A code will describe the classified complex (example, number = 1-10-03). The complex name will add the existing dominant vegetation community type. An example is: 1-10-03 - SAGE/CARO. The name is derived from other data on the form - this field is completed last.

Name of Water Body

Indicate name of stream, lake, marsh, etc.

District

Write District name.

Date

Write out date in full. (MM/DD/YY)

Quad Name or Number

Indicate USGS quad name, or number if available.

Geologic Parent Material

Write the broad category such as granite, basalt, etc., and the National Soil Handbook, Part 607, to select correct term.

Aspect

Use the eight point system, i.e., N, NE, E, etc. Enter the aspect of valley floor direction looking downstream or aspect of dominate drainage pattern in case of meadows, bogs, seeps, lakes, etc.

Valley Bottom Type

See Appendix D for codes.

Stream Type

Use the code from the system developed by Rosgen designate classification used, 1985 or 1991. Type is determined by estimating stream gradient and substrate size distribution (from pebble counts) and size codes come from Rosgen subtypes, (Appendix E.)

Stream Gradient

Determine this using rod and level or estimate from the map using elevation change divided by map-measured stream length. Gradient measurements should represent the entire complex, not short reaches.

Elevation

Downstream elevation: Elevation at lower boundary of the complex. Upstream elevation: Elevation at the upper boundary of the complex. Mid elevation: Elevation midway through the complex (not an average of downstream and upstream elevations).

Size of Complex

Length: Record length (or longest axis of riparian area) in feet. Width: Record average width of complex in feet. Area: Record in acres taken as the length times the average width divided by 43,560. All measurements are generally taken from the topographic map or aerial photo.

Soil Families

Soils are described by examining soil pits and/or channel cutbanks. Soil family: Record the name starting with the most dominant family. Percent composition: Record estimated percent composition of each soil family. Compaction: Record from penetrometer measurements, or other method for each soil family and qualitatively select slight, moderate, or sever.

Adjacent Upland Vegetation; Looking Downstream

Record adjacent upland vegetation immediately next to the riparian area for both valley side slopes. Special attention should be given to adjacent aspen communities which are within 100 yards of the riparian area. This will be necessary for analysis of beaver habitat.

Vegetative Description

List names of all community types, their percent composition (to the nearest 5 percent), and name of potential natural community expected to occupy site if allowed natural succession. This should be done at or near the end of the evaluation so that the entire complex is considered. The potential community may or may not be the same as the existing community. Community type classification publications have been developed for various parts of the Intermountain Region.

Successional Status

Indicate whether the vegetation on the complex being evaluated is considered at potential or seral status. Complexes known to be undisturbed or those with high vegetative ecological status (such as Research Natural Areas) should be noted as "Potential Natural Complexes". These will be used as reference sites to develop a score card system depicting vegetation seral status for the same complex located at disturbed sites.

Apparent Forage Trend

Record as "up," "down," or "not apparent." Trend is usually considered as change over time and requires more than one year's measure on a given site. It applies only to the group of plants considered as "forage" for grazing ungulates on the land. It does not apply to non-forage species. Apparent trend may be inferred from

a single site visit using such things as the presence of seedling, sapling, and young woody regeneration, hydric species composition of the greenline, etc.

Estimated Forage Production

Record an ocular estimate of total pounds of all species considered to be palatable forage species for the class of livestock present. Do not include non-forage species. Refer to species list on Level II form.

Beaver Habitat

Record the number of beaver caches in active ponds, the number of active dams and the number of inactive dams.

Green Line (Hydric Vegetation)

Green Line is the first perennial vegetation from the water's edge. This is an ocular estimate of the percent of the total green line within the riparian complex occupied by desirable hydric vegetation community types using both sides of the stream or waterbody. (See Figure 3 of this publication.)

Photo Identification

Record frame number(s) and/or any other information to key photos to the data.

Land Use Activities

Types are identified and recorded. Make a subjective estimate of the influence of these activities on the riparian area condition rate as 0 to 4, with 0 being no apparent influence, and 4 being substantial impact. Indicate if the activity is within or adjacent to the riparian area, W = within, A = adjacent, and 0 = offsite. For livestock, rate and indicate the class--S&G or C&H or dual. For mining indicate the amount of alteration to the landscape. Rate timber harvesting impacts separate from roading impacts. ORV impacts are rated separately from other recreation activities such as dispersed uses, trails, etc.

Comments

Any additional observations not accounted for on the form should be added. An additional page may be attached if comments are lengthy. Observed indicators of watershed instability (i.e., headcutting, excessive bar development, slumps, debris avalanche) should be highlighted here.

Species List

The right side of the form provides space to list riparian community types and/or species encountered in the complex. The observer enters the species or community types by overstory dominance (tree, shrub, graminoid forb) while progressing through the complex. The observer also estimates percent of the composition. This species list is used for keying community types that are recorded in the vegetative description for the complex.

E. Instructions for Completing Riparian Aquatic Data Sheet (Level II)

When using the "Single Ocular Estimate" (SOE) approach, entries will only be made in column 1 of the Riparian Aquatic Data Sheet (Level II). When using either the "Representative Segment Estimate" (RSE) or "Multiple Sample Estimate" (MSE) approaches, entries will be made in all five columns.

When applying the SOE approach, estimate the average value for each attribute after traversing the entire stream length within the complex. When applying the RSE or MSE approaches, habitat attribute data are generally estimated. However, channel dimension and bank length data can be measured rapidly using a rod or measuring tape. Indicate measured data by placing an "M" in the left-hand margin adjacent to those attributes which were measured.

When applying the RSE approach, all attributes (with the exception of the channel morphology data) are estimated as a percent of the area, or bank length, within each stream section making up the representative segment. Channel morphology data are estimated or measured at the upper end of each of the five sections making up the representative reach.

When applying the MSE approach, estimate the average value for each attribute at each of the five stream segments sampled in the complex. If channel morphology data are measured, measurements are taken 1/4, 1/2 and 3/4 of the way between the bounds of each segment and the average of the three measurements is entered for the attribute.

% *Area in Pools*: Estimate percent stream surface area within the complex (SOE), section (RSE), or segment (MSE) that is "pool."

% *Pool Area Made up of Pools at Least 2' Deep*: The meaning of this entry is best explained by the formula:

$$\frac{\text{stream surface area of pools that have a maximum depth} > 2' \text{ X } 100\%}{\text{stream surface area of all pools}}$$

Estimate the percent pool area made up of pools at least 2' deep for the stream area within the complex (SOE), section (RSE), or segment (MSE).

% *Streambed with Filamentous Algae*: Estimate the percent of wetted streambed area covered with filamentous algae within the complex (SOE), section (RSE), or segment (MSE).

% *Stream Margin with Rooted Aquatic Vegetation*: The focus of this entry is on identifying the percent of the lineal stream margin that supports rooted, true aquatic plants such as water cress (*Nasturtium officinale*), water-buttercup (*Ranunculus aquatilis*), or brookgrass (*Catabrosa aquatica*). In making the evaluation, consider both stream margins. Estimate percent of the total lineal stream margin supporting rooted aquatic vegetation within the complex (SOE), section (RSE), or segment (MSE).

% *Bank Length - Undercut*: Banks with a bank angle less than 90 degrees are considered to be undercut (Platts, et. al., 1983). Consider both banks when making this evaluation.

Estimate the percent of lineal bank length in the complex (SOE), section (RSE), or segment (MSE) that is undercut.

% *Bank Length - Gently Sloping*: Banks with a bank angle greater than 135 degrees are considered to be gently sloping. Consider both banks when making this evaluation.

Estimate the percent of lineal bank length in the complex (SOE), section (RSE), or segment (MSE) that is gently sloping.

% *Bank Length with Overhanging Vegetation*: To be counted as overhanging vegetation, terrestrial vegetation must hang beyond the streambank and over the water at least one foot and be within one foot of the water surface (at the time of the survey).

Estimate the percent of lineal bank length in the complex (SOE), section (RSE), or segment (MSE) that supports overhanging vegetation.

Bank Condition: Bank condition is estimated as a percent of lineal bank distance by four categories: vegetated/stable; vegetated/unstable; unvegetated/stable; and unvegetated/unstable. An "unvegetated" streambank (as viewed where the bankfull flow would meet the bank) is defined as being bare ground (or essentially bare, with a few scattered "annual" plants), or where the bankfull flow meets a steep or undercut bank below the rooting depth of the begetation that occupies the top of the bank. Other streambanks are considered "vegetated." A "stable" streambank (as viewed along teh steepest sloped portion of the channel between the bankfull and existing water level) shows no evidence of active erosion, breakdown, tension cracking, shearing, or slumping. Undercut banks are considered tension creacking, shearing, or slumping. Undercut banks are considered stable until tension fractures show on the ground surface at the back of the undercut. All other banks are considered "unstable."

Consider both banks when estrimating the percent of bank length that is vegetated/stable; vegetated/ unstable; unvegetated/stable; unvegetated/unstable in the complex (SOE), section (RSE), or segment (MSE)."

Bankfull - Width, Max Depth, Shore Depth (L/R), Shape: The "bankfull" channel is defined as that portion of the channel within the bounds of streamside vegetation, as typically defined by the mean annual high flow. The bankfull "width" does not include the distance beneath undercut banks. The "maximum depth" is an estimate of the deepest portion of the water column at bankfull flows. "Shore depth" is defined as an estimate of the water depth at bankfull flow, immediately adjacent to edge of the bankfull channel, for the left (L) and right (R) banks.

Width (to nearest foot/meter): Estimate the average bankfull width at across section typical of the stream within the complex of the stream (SOE); estimate/measure the bankfull width at the upper-end of each section (RSE); or estimate the average bankfull width for each segment (MSE).

Max Depth (to nearest 0.1 foot/meter): Estimate the maximum bankfull depth at a cross section typical of the stream within the complex (SOE), estimate/measure the maximum bankfull depth along a channel cross section at the upper end of each section (RSE), or estimate the maximum bankfull depth at a cross section typical of the segment (MSE).

Shore Depth (L/R) (to nearest 0.1 foot/meter): Estimate bankfull shore depth (at the left and right banks) at a cross section typical of the stream within the complex (SOE); estimate/measure the bankfull shore depths along the channel cross section at the upper end of each section (RSE); or estimate the bankfull shore depths at a cross section typical of the segment (MSE).

Shape: Describe the shape of the bankfull channel as: rectangular (R), triangular (T), trapazoidal (Z - both banks are undercut, as a result bankfull width is less than stream bottom width), or inverse trapazoidal (IZ - bankfull width is greater than the stream bottom width).

REMINDER: If measured, bankfull channel dimension data are desired using the MSE approach, parameters are measured at 1/4, 1/2 and 3/4 the distance between the bounds of each segment, and the average of the three values is entered on the data sheet.

Water - Width, Max Depth, Shore Depth (L/R), Shape: Water "width" includes the length of the water surface perpendicular to flow plus the depth of wetted undercut banks. "Maximum depth" is the deepest portion of the water column at existing flow conditions. "Shore depth" is the depth of the water at the water's edge (or bank edge in the case of undercut banks) for the left (L) and right (R) banks.

Water Dimensions: Are assessed in the same manner (and locations) as described for bankfull channel dimensions.

Shape: Describe the shape of the wetted channel as: rectangular (R), triangular (T), trapazoidal (Z - both banks are undercut, as a result bankfull width is less than stream bottom width), or inverse trapazoidal (IZ - bankfull width is greater than the stream bottom width).

Substrate Composition: Substrate composition is estimated as a percent of *total* (i.e., not wetted) streambed area by seven size categories. "Sand/Silt" particles are .1" or smaller. "Coarse fines" are greater than .1 but no larger than .25. "Gravel" particles are greater than .25", but no larger than 3.0". "Rubble" is greater than 3.0", but no larger than 6.0". "Cobble" is greater than 6.0", but no larger than 12.0". Particles greater than 12.0", but no larger than 36.0" are classed as "Boulder". All particles larger than 36.0" are classed as "Large Boulder"/"Bedrock". (NOTE: All dimensions refer to the intermediate axis of the particle.)

For each of the Level II aquatic inventory approaches, substrate composition may be estimated ocularly or by "pebble count." Estimate the percent of bankfull streambed area that is composed of sand/silt, gravel, rubble, cobble, boulder, large boulder and bedrock within the complex (SOE), the section (RSE), or segment (MSE).

Appendix F "Determining Bed Material Particle Size Distribution," describes a general approach for conducting pebble counts. A 1/10 inch ruler is required to measure pebbles in the stream. If pebble counts are made, they should be conducted at one or more cross sections representative (i.e., have a similar portion of pools, riffles, etc., in the cross section) of the stream within the complex (SOE), section (RSE), or segment (MSE). A work table is provided at the bottom of the data sheet to record pebble counts.

Embeddedness

The term embeddedness, as used here, is simply an estimate of the degree that gravel, cobble, and boulder particles are surrounded or covered by sand/silt. Separate ocular estimates are made for substrate embeddedness at suitable spawning, food production, and rearing/overwintering locations or as many of those types as occur in the complex (SOE), section (RSE), or segment (MSE). The estimates should provide a general picture of substrate embeddedness. Enter estimated percent embeddedness to the nearest 10 percent.

Comments

Comments should be made on an additional page to document observations about aquatic habitat improvement potential, fish presence and use, the condition and use of riparian dependent resource values, i.e., terrestrial habitat, sediment sources, soils and vegetation; i.e., which are relevant to the riparian complex.

Chapter 4 - LEVEL III RIPARIAN AREA EVALUATION

Chapter 4. LEVEL III RIPARIAN AREA EVALUATION

A. Objectives

1. Provide detailed quantitative site information for riparian complexes to:

   a. *Describe current status.*

   b. *Quantify potential.*

   c. *Provide data for defensible management decisions.*

   d. *Validate Forest Standards and Guidelines.*

   e. *Develop design criteria for riparian and aquatic habitat improvement projects.*

   f. *Quantify management effects.*

   g. *Identify factors limiting achievement of potential or management goals.*

2. Provide a monitoring framework to evaluate management activities.

The decision to complete a Level III evaluation is *issue* driven. There must be a need for the information detail that Level III generates. A number of resource surveys are described in this Chapter. Each Forest will identify by project area which surveys to use. Surveys that are not included in this handbook may also be used.

B. Guidelines

Identify specific objectives for conducting a Level III riparian evaluation and the information needs to address those objectives. Identify and apply suitably efficient and reliable techniques to provide the needed information. Data forms for Level III vegetation, channel morphology, and aquatic community habitat surveys are included in Appendix A. Other resources are to be inventoried using existing procedures and forms. Assessment of some resource attributes may require development of new methodology and data forms. If an undocumented technique is used, the Forest should document the assumptions and procedures used. All forms used in Level III riparian evaluation need to include the Key ID number described in Level II so that eventual data base linkages may be made.

Guidelines related to the two principal purposes for Level III riparian evaluations follow.

1. Complex Characterization

Level III riparian evaluations employ methods to quantitatively describe the physical and biological characteristics of a riparian complex. Data collection for characterization often involves use of subsampling techniques within a complex.

A variety of resource attributes must be examined to adequately characterize riparian complexes. All resource surveys including channel morphology, fish habitat, vegetative cross section, green line, soils, and foliage height/volume information should be conducted in a manner that allows them to be tied to specific sample locations within the complex. Some resource attributes, such as those associated with vegetation, will be surveyed only at the specific sample locations. Others will be sampled over the entire complex. For example, if soil information is lacking, a soil map for the entire complex will be produced to the Order 1 or 2 intensity

level. Channel morphology and aquatic community habitat attributes will be evaluated over the length of the stream in the complex using a calibrated ocular estimation (COE) survey approach described by Hankin and Reeves (1989) (see Appendix H).

2. Monitoring

Forest Service policy recognizes three types of monitoring: Implementation, effectiveness, and validation. These strategies are to be applied to monitor Forest Plan implementation. They are also useful in determining if requirements of the Clean Water Act, as administered by the State water quality agencies, are being met (i.e., applied best management practices are protecting beneficial uses).

Implementation monitoring documents whether or not management practices were applied as designed. Project and contract administration is a part of implementation monitoring. During riparian projects, the project administrator or contracting officer documents proper implementation and reasons for variance from design.

Effectiveness monitoring documents how well the management practices meet intended objectives for the riparian area. The Riparian ID Team reviews projects on-site during or after implementation to evaluate design adequacy and to provide feedback on needed additions or changes. Monitoring evaluates the cause and effect relationships between management activities and condition of the riparian dependant resources. Terrestrial and in-stream methods together constitute monitoring that evaluates and documents the total effectiveness of site-specific actions.

Validation monitoring determines if predictive model coefficients and assumptions are appropriate. A long-term commitment to data collection is often required to establish an adequate data base. If the standard requires utilization of no more than 50 percent of streamside herbaceous forage for example, and this fails to achieve the desire instream habitat condition, the standard would have to be modified, for less forage consumption for the riparian complex(s).

A fourth type of monitoring, sometimes referred to as "baseline monitoring," also has application to riparian monitoring. Baseline monitoring is conducted to determine long term trends, natural variability, and/or to provide a benchmark for comparison purposes. Recurring inventory of "reference complex" characteristics is an example of a common type of baseline monitoring. In this case, baseline monitoring is used to define "potential" and "natural variability" for specific riparian complexes. These "reference conditions" provide the basis of comparison for effectiveness monitoring.

Selection of physical and biological attributes for monitoring riparian conditions should be based on Forest Plan standards and guidelines, desired future conditions, state water quality standards (related to protection of beneficial uses such as salmonid spawning, cold water biota, primary and secondary contact recreation, and domestic, municipal, and agricultural water supply), and on specific project objectives for the riparian area. Methods used to monitor and evaluate these attributes should be well documented, replicable between years and observers, and result in quantitative data with known reliability (i.e., confidence intervals).

C. Methods

This section briefly describes some techniques for characterization and monitoring of riparian complexes. The methods are listed under these two objectives by functional area for organizational purposes. However, the results need to be assessed in an interdisciplinary framework to draw conclusions and make management recommendations.

In addition to the methods listed below, photographs may be used to visually represent the data being collected. Although photographs may not be used to provide quantitative data, they can be an important aid

in information transfer and understanding. Photographs should be taken in the same locations that data are being collected. If photographs are to be used to document changes through time, the photo location should be monumented and the compass bearing of the photo documented. Photographs taken with 35mm color print film is best suited for reports and small documents. Black and white print film is best suited for publications. Some may desire to use slide film and have prints made from the slides, while others may choose to use two cameras - one for slides and one for prints.

1. **Complex Characterization**

a. **Aquatic Community Habitat**: Some suitable techniques and recommendations for their application follow.

(1) **Calibrated Ocular Estimation (COE) Survey**: The COE survey approach can be used to efficiently provide quantitative information on current aquatic conditions within a complex or over several complexes. This approach provides the means to assess complex conditions and evaluate dispersed and cumulative land use effects. Because aquatic habitat types are the basic sample unit of this approach, COE surveys generate information useful for identifying environmental features limiting fish production and developing project design criteria. See Hankin and Reeves (1989) and Appendix H for additional information.

(2) **Macroinvertebrate Survey**: Macroinvertebrate community composition and relative species abundance can be effectively used to evaluate the overall health or condition of aquatic community habitat. GAWS Macroinvertebrate survey procedures and data forms are referenced in R-4 FSH 2609.23. EPA Rapid Bioassessment procedures may also be employed (Plafkin, et. al., 1989).

(3) **Instream Flow Survey**: The Region's GAWS instream flow survey methodology can be used to estimate the quantity and quality of aquatic community habitat available at flow levels other than those measured at the time of survey. It may be appropriate to apply the inventory technique where activities are proposed that would depleat or supplement natural flow regimes. Survey procedures and data forms are referenced in R-4 FSH 2609.23. Where litigation related to the findings is anticipated, it is recommended that the U.S. Fish and Wildlife Service's "Instream Flow Incremental Methodology" be applied. Regardless of the methodology applied, it is important that a COE survey of the stream or stream reach be completed prior to selection of instream flow study sites.

(4) **Fish Population Survey**: A variety of standard fish population survey methods may be used to inventory and monitor fish population characteristics. Fish population surveys must be coordinated with and/or performed by state fish and wildlife management agencies. Where water clarity and stream size permit, visual estimation techniques described by Hankin and Reeves are recommended. Where visual estimation is not possible, it may be necessary to employ removal-depletion or mark-recapture electrofishing techniques to estimate fish species/life stage composition and abundance. Because of wide natural fluctuations in year-class strength, a paired comparison to reference (i.e., control) will be necessary to assess fish density trends over time.

b. **Soils Data and Inventory**:

The kinds of soils and soil materials play a key and important role in the riparian area. The particle size distribution and sequences in which soil materials have been deposited during fluvial processes directly effect riparian area function. Riparian soils may be both saturated and unsaturated. During the Level III riparian evaluation, soil data is collected on depth of soil mottles, texture, color, structure, cohesiveness, stratification of parent materials, boulders and cobbles, percent of coarse fragments in the dominate soils, buried organic horizons, thickness of organic surface, ground water table and other soil parameters. The soil inventory report generally provides information on geomorphic, process, soil parent material, soil substrata, landforms, soil temperature and moisture regimes and other soil related factors in the landscape.

Soil information is analyzed and interpretative information can be provided for such key areas as:

Surface erosion
Stream bank stability
Soil compaction
Soil productivity potentials
Soil revegetation potential
Area extent of riparian area (based on free and unbound soil water)
Influence on ground water movement

Orders of intensity in soil inventory are necessary to designate the detail of soil information on which management decisions will be based. Detailed soil information is needed if stream structures are to be constructed to raise the water table and stabilize the banks of a severely eroding riparian area. This would require refined distinctions among small, homogeneous areas of soil. The orders of intensity are intended to obtain only the necessary detail and no more, to answer these questions about soils. See Soil Survey Manual, Chapter 2, page 2-14, for Key for Identifying Kinds of Soil Surveys which compares the five orders of soil survey. The number of map units, their composition, and the detail of mapping vary with the complexity of the soil patterns and the specific needs of the user. Thus the soil survey intensity is matched to the needed uses and the soil-related problems of the area. The soils mapped in an inventory will be identified by names that serve as references to a national system of soil taxonomy.

(1) ***Order 1 Surveys:*** First order surveys are made for very intensive land uses requiring very detailed information about soils, properties for generally small areas. The information can be used in planning for land drainage, construction sites, materials for streams or streambank protection, Habitat Type management prescriptions, and other management uses that require very precise site-specific knowledge of the soils and their variability.

Field procedures permit observations of soil boundaries throughout their length. The soils in each delineation are identified by transecting or traversing. Remote sensing is used as an aid in boundary delineation. Map units are mostly; consociations with some complexes, and are phases of soil families, soil series, or are miscellaneous areas. Delineations have a minimum size of about 1 hectare (2.5 acres) or less, depending on the map scale, and contain a minimum amount of contrasting inclusions within the limits permitted by the kind of map unit used. Soil map base scale is generally 1:15,840 or larger.

(2) ***Order 2 Surveys:*** Second order surveys are made for intensive land uses that require detailed information about soil resources for making predictions of suitability for use and of treatment needs. The information can be used in planning for general land disturbances, construction of roads and bridges, vegetative manipulation, or some broader Habitat Type prescriptions, and similar uses that require precise knowledge of the soils and their variability.

Field procedures permit plotting of soil boundaries by observation and by interpretation of remotely sensed data. Boundaries are verified at closely spaced intervals, and the soils in each delineation are identified by transecting or traversing. Map units are mostly consociations and complexes. Occasional undifferentiated groups or associations are also used. Components of map units may be phases of soil families. Delineations are variable in size, with a minimum of 0.6 to 4 hectares, (1.5 to 10 acres) depending on landscape complexity and survey objectives. Contrasting inclusions vary in size and amount within the limits permitted by the kind of map unit used. Base map scale is generally 1:12,000 to 1:31,680, depending on the complexity of the soil pattern within the area.

An accompanying report describes, defines, classifies, and interprets the soils. Interpretations predict the behavior of soils under different uses and the soils' response to management.

(3) ***Soil Compaction***: Compaction of soil increases soil bulk density and decreases porosity as a result of the application of mechanical forces such as weight and vibration or animal trampling. Soil compaction is determined by ocular estimating and volumeteric core sampling. Compaction sampling is accomplished along the vegetative cross-section transects, with two or three samples taken for each dominant soil type where they support dominant vegetative community types. Samples are needed for both disturbed and undisturbed sites for comparison. (Reference, Interim Guidelines For Sampling Soil Resource Conditions, USDA Forest Service, R-6, 1981.)

Soils differ in their inherent ability to resist compaction. Important factors needing evaluation include: soil texture, soil structure, organic matter content, and rock fragment content.

(4) ***Soil Puddling:*** This condition occurs under wet-soil conditions when the exerting force mechanically destroys the soil structure by compression and shearing. It results in total deformation of the soil particle process. It is usually a problem in soils with a clay content greater than 35 percent or with a moisture content at or greater than field capacity (35-53 percent moisture by weight, depending upon texture.) Bearing strength of the saturated soil under compression approaches zero. The saturated soil cannot support vehicle traffic or trampling by animals or humans without sustaining damage. A puddled soil inhibits root, air and water movement. The natural restoration period is not specifically known but, field evidence indicates that it may persist somewhat less than compaction because the puddled zone is relatively thin (Moehring, 1970).

c. **Hydrology and Stream Dynamics**:

Although riparian evaluation is not intended to be the vehicle for completing Water Resource Inventory, it is often necessary to conduct a water resource investigation to provide answers to specific questions or resolve problems identified by the Level I or Level II Riparian Evaluations.

The appropriate Order of Water Resource Inventory for Level III riparian evaluations depends on the questions to be answered or project(s) being proposed. Order 2 inventory would be used to evaluate watershed level influences on the riparian complex(es) of concern. Order 1 inventory may be used for site-specific design purposes.

Water Resource Inventory for Level III riparian evaluations must ultimately identify any watershed level phenomenon that is influencing the complex(es) of concern, including watershed condition, upland hydrology, off-site erosion, water quality, landform processes, base level changes, flow regime, and management influences. The Water Resources Inventory Handbook (FSH 2509.16) should be consulted to design and execute the inventory.

In addition to the hydrologic measurements taken in the aquatic community habitat section, the following hydrologic evaluations should be considered. The issues driving the Level III riparian evaluation may require specific types of water resource investigations. These may be:

(1) ***Channel Maintenance Instream Flow Quantification***: (used when dewatering, stream diversions, hydropower, water rights, etc. are issues.)

(2) ***Floodplain (and Wetland) Delineation and Analysis***: (when facilities development, peak flows, management influence on peak flows, etc. are issues. See FSH 2509.17, Chapt. 20 for details.)

(3) ***Water Quality Investigations:*** (see FSH 2509.16 for references concerning water data acquisition.)

(4) ***Channel Morphology***: (when channel and floodplain hydraulics, aquatic habitat, etc. are issues, and monitoring is desired. Use standard channel cross-section survey procedures.)

(5) ***Channel Stability***: For sediment erosion in meadow streams, see example figure 6. When evaluating forested streams, see Channel Stability Evaluation Chart (Appendix F).

For the bulk of riparian complexes evaluated at Level III, the hydrologist will further refine the information gathered in previous levels. This will include verification of the ocular stream typing from Level II using a Wolman pebble count and possibly a description of stream sub-types present in the complex. See the Interpretations and Applications Section of this Guide for how this information is used.

A number of interpretations from water resource inventory information are made by extrapolating relationships to similar watersheds. Level III riparian evaluation may be used to verify those relationships for site-specific conditions on the Forest or derive new relationships. A well designed monitoring program is required to derive these relationships.

d. **Vegetation**:

Several inventory processes are available to gather intensive vegetation information at Level III. Any or all of the following approaches may be used, depending on specific needs.

Each riparian complex is usually composed of a mix of 4 to 10 community types. A measurement of the percent each type covers within a complex (community type composition) can provide an indication of potential or ecological status. The percent of the complex covered by community types which are indicators of unnatural disturbances, such as heavy grazing and trampling or soil compaction from recreational activities, provides an indication of impact. These measurements can be used to determine if management has been suitable for achieving the predetermine desired condition on areas where desired future condition has been identified based on presence or absence of specific community types.

If there is a set kind and number of community types within a complex in "natural" condition, and if new types enter the scene when "unnatural" disturbing factors are present, we can measure the percent composition change in the types through two different line intercept processes.

(1) ***Cross-Section Composition***: Several pace transects (at least five) are established perpendicular to the riparian complex in such a way as to cross the entire riparian area (Figure 2). Beginning and ending points for each transect are permanently marked with stakes that should be placed far enough back into the non-riparian area to allow subsequent measurements in case the riparian area expands. Community type composition is obtained by tallying the number of steps encountered for each type in relation to the number of total steps used in all transects. A hand held tally whacher (counter) will aid in this sampling process. Note, since different individuals have distinct step lengths each person should test themselves with a measured transect so that steps can be converted to feet. For Cross Section Composition and Cross Section Composition Summary Sheet (Level III), see Appendix A. Photographs will be taken at each of the permanent starting point cross section stakes. The photographs will depict the setting of the cross section. Photographs are also taken at the location(s) where the cross section crosses the stream channel. Optional photos can be taken from each stake.

Percent composition for each community type is calculated as follows: (Assumes examiner's step equals 2.5 feet):

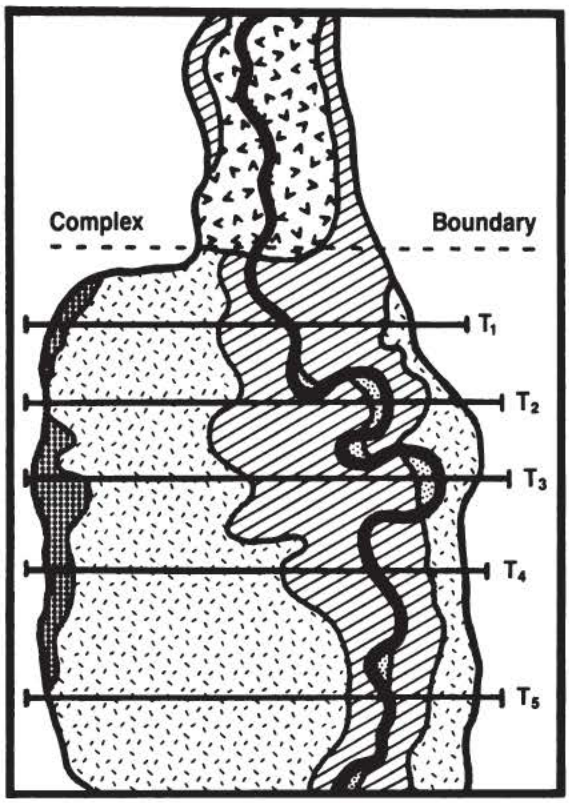
Total number of feet for the Kentucky bluegrass community type		**Steps**	**Feet**
	$= T_1$	20	50'
	$= T_2$	18	45'
	$= T_3$	18	45'
	$= T_4$	24	60'
	$= T_5$	32	80'
		112	280'

Total number of feet sampled in all transects		**Steps**	**Feet**
	$= T_1$	40	100
	$= T_2$	40	100
	$= T_3$	40	100
	$= T_4$	40	100
	$= T_5$	40	100
		200	500

Composition of Kentucky bluegrass for the complex = 280/500 = 56 percent similarly, the composition of redtop for the complex = 30/500 = 6 percent (Figure 2).

Composition of all community types encountered in the complex should total 100 percent.

VEGETATION COMPOSITION WITHIN A COMPLEX



	T_1	T_2	T_3	T_4	T_5	% Comp.
Alder/ Dogwood						
Willow/ Beaked Sedge	40	45	35	25	20	(33)
Kentucky Bluegrass	50	45	45	60	80	(56)
Redtop		10	5	15		(6)
Catgrass	10	T	15			(5)

Percent Disturbed = 62

FIGURE 2. Use of the line intercept method to measure amount of change in community type composition after unnatural disturbances.

If the presence of Kentucky bluegrass and/or red top represents disturbance types in a complex, 62 percent of the area indicates disturbance (56 percent Kentucky bluegrass plus 6 percent red top).

The willow/beaked sedge and oatgrass community types which makeup 38 percent of the complex and are known to be natural to the area, indicate the complex is in a early-seral status.

Natural Types	**Ecological Status**	
Willow/beaked sedge	= 33	0 - 15 = very early seral
Oatgrass	= 5	16 - 40 = early seral
	----	
	38 percent	41 - 60 = mid seral
		61 - 85 = late seral
		85 + = PNC

(2) ***Green Line Vegetation Composition***: Sampling community type composition along edges of live water can provide additional information over that collected by the cross-section process. Presence of permanent water in the plant rooting zone allows more rapid recovery of vegetation after disturbances. This permits a land manager to make an earlier evaluation of management geared to improve riparian condition. Also, measurement of this portion of the riparian area provides an indication of short-term trend for the riparian area. This is where the forces of water, as influenced by total watershed condition, play their most prominent role. Additionally, there is a strong relationship between amount and kind of vegetation along the water's edge and bank stability. Natural plant species in this permanently watered area have developed rooting systems which enhance bank stability. An evaluation of the vegetation in this area can thus provide a good indication of the general health of the entire watershed.

The green line is defined as that specific area where a more or less continuous cover of perennial vegetation is encountered when moving away from the perennial water source (Figure 3).

At times, the green line may be at the water's edge. Or, it may be part way back on a gravel or sandbar. The green line may be only a foot or two wide, or may be many feet wide, depending on soil and water features. Natural plant species forming the green line (e.g., beaked sedge or water sedge) are generally good buffers of water forces. Disturbance activities, such as overgrazing or trampling by animals or people, result in changes to species such as Kentucky bluegrass or red top, both of which have a reduced ability to buffer water forces.

In most riparian settings, there is a continual effort by nature to form this green line of vegetation, even where the adjacent community types are composed of the more shallow-rooted species. Well developed green line vegetation stabilizes channel banks and buffers water forces. This enhances channel stability, even for inherently unstable stream types. Therefore, an evaluation of the community type composition of the green line can provide a good indication of the general health of the riparian area.

The following procedure is used for the green line transect. The green line transect begins on the right-hand side of the stream (looking downstream) at the point where the cross section composition transect intercepts the green line (Figure 3). In settings where the stream has multiple channels, use the current most dominate channel. Sampling proceeds down the green line using a step transect approach as described in the cross-section composition measurement. Enough steps should be taken to total 363 feet lineal distance. A temporary marker is placed at the end of the transect for location of subsequent shrub measurements. The sampler then crosses the stream and repeats the sampling process for 363 feet upstream.

GREEN LINE VEGETATION COMPOSITION MEASUREMENT

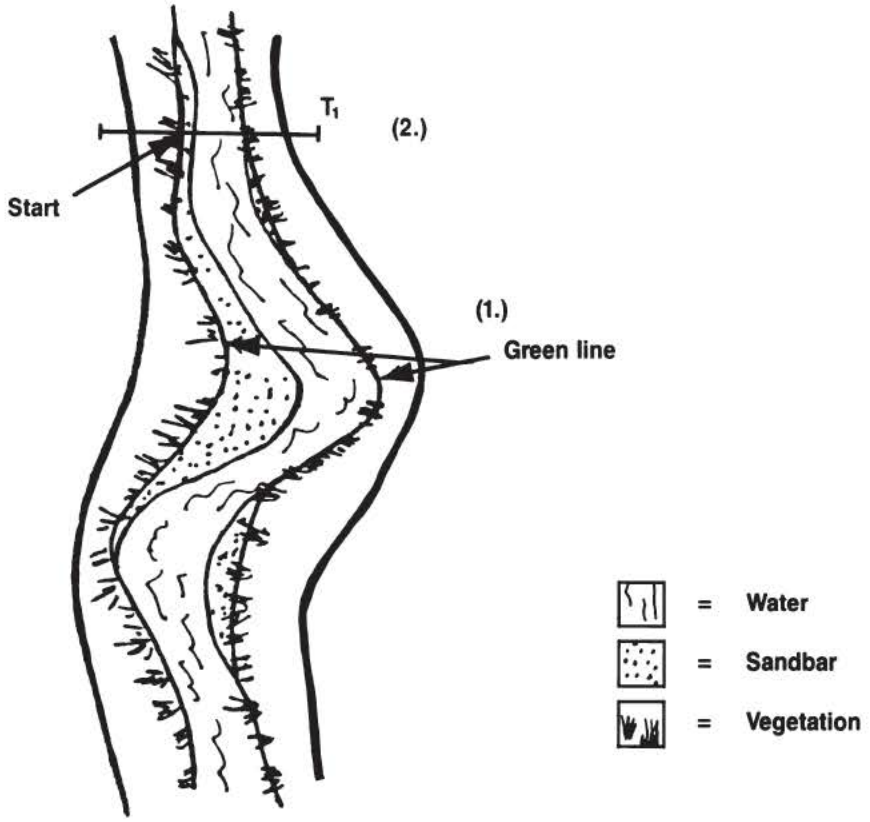
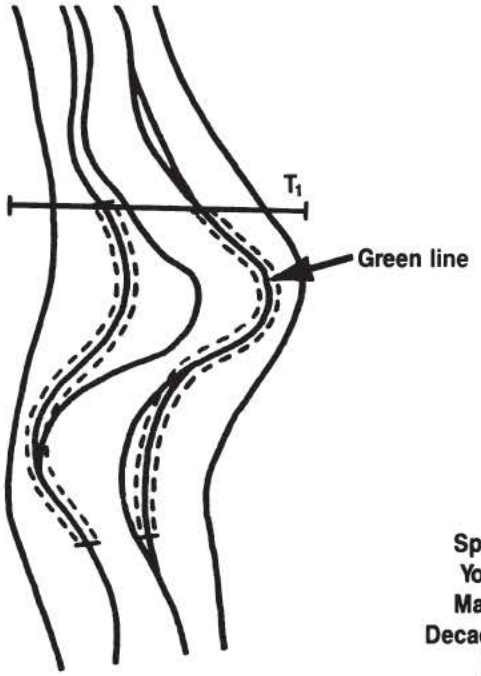


FIGURE 3. Location of (1) the green line in relation to the water's edge and to sandbars and (2) location of the green line transect in relation to the cross-sectional transect.

SHRUB COUNTS
(by Age Class)

363 ft. each side (726' total)
3 ft. each side of green line =6 ft. wide belt } = 1 / 10 Acre



Example

Sprouts	3
Young	21
Mature	12
Decadent	10
Dead	2

= Healthy Reproduction

FIGURE 4. Example of woody species status using a tally of individual plants, by age class, in a 6-foot wide belt along the green line. A belt transect six feet wide by 726 feet long equals one-tenth acre sampled.

NOTE: The stopping point may not coincide with the initial starting point on the other side of the stream due to difference in lengths of meanders on each side of the stream. It is important to measure both sides of the stream since activities (grazing pressures or water forces) may be different on each side.

On certain streams, especially those with steep gradients, the number of feet of large anchored rocks or large logs should be tallied in place of the vegetation. Rocks and logs must be large enough to withstand the forces of water and must appear stable in the setting being measured. The number of feet of rocks and logs would be counted as a natural stable percentage of the green line.

The total number of feet of each community type encountered along the green line is tallied and composition for each type computed as described in the cross section composition measurement.

e.g., $\frac{\text{Total feet of each type (left and right side)}}{\text{726 feet (363 feet minimum each side)}}$ = Community Type Composition

An evaluation of percent of disturbance types in relation to percent of natural types (see cross-section computation) provides an indication of ecological status.

A comparison of settings where the complex is as close to PNC as possible may be used as a standard or reference to evaluate ecological status of the green line communities. Additionally, subsequent measurements of the same area will provide a measurement of trend for that complex.

A photograph can be taken at the starting point of the green line transect, looking downstream. Additional photos may be taken along the transect if desired. These photographs should contain some reference point or marker (boulder, large tree, etc.) so the photograph can be re-established in the future.

(3) ***Woody Species Regeneration***: A measurement of woody species regeneration is made along the same green line transect (Figure 4). The sampler uses a 6-foot pole which has the center marked. Measurements are made by walking 363 feet on each side of the stream with the center of the pole held directly over the edge of the green line adjacent to the waterbody. Use of the green line edge as the center of the measurement helps to assure that the sampling is done in a setting where regeneration is most likely.

A modification of the above procedure may be necessary for narrow water bodies. In these settings do not allow the left tip of the pole to extend beyond the center of the waterbody. When that would occur, align the left tip of the pole on the waterbody (the pole is no longer centered on the green line edge. This modification eliminates double sampling when measuring from both sides, yet insures that a full one-tenth acre area is sampled.

All woody species rooted within the ends of the pole (3 feet either side of green line) are tallied based on the following age class categories.

	Number of Stems	**Age Class**
1. Number stems =	1	- sprout
2. Number stems =	2 to 10	- young
3. Number stems =	>10, >1/2 alive	- early, mature
4. Number stems =	>10, <1/2 alive	- late, mature
5. 0 stems alive =		- dead or decadent

A tally of shrubs by age class provides a preliminary indication of regeneration of shrubs in that complex. A high proportion of plants recorded in the sprout, young, and early mature categories would indicate the shrub component in this complex is in an upward trend. Conversely, low numbers of plants in the sprout and young

categories would indicate current management may be suppressing woody species. A comparison of settings where the complex is in as close to PNC as possible may be used as a standard to evaluate overall shrub status. Subsequent measurements on the same area will provide a measurement of woody species regeneration trend.

For smaller statured species such as *Salix wolfii*, change the number of stems from ten to five. And, for single stemmed species such as *Salix exigua*, *Betula* spp., and *Alnus* spp., count each stem that occurs 12 or more inches from each other as a separate plant. Place these into age classes based on overall size and health.

Not all riparian areas are well suited for growing woody species. This appears to be especially true where the complex has a low gradient and a limited amount of natural stream channel movement. In these settings, understory sedges and rushes are able to buffer the forces of water without the addition of woody species. It must be noted that most of the woody riparian species in the Intermountain Region regenerate best on settings where there is minimal competition from herbaceous species.

(4) ***Nested Frequency***: See Range Analysis Handbook.

(5) ***Production***: See Range Analysis Handbook.

e. **Terrestrial Habitat:**

The wildlife habitat data and vegetation data collected during the Level II evaluation should be used during Level III as a basis for developing and observing wildlife relationships to the riparian areas and adjacent upland. Observations about wildlife use patterns and presence of various wildlife species should be noted; wildlife species generally respond to vegetation and in Level III, species/habitat relationships should be established; non-game species such as songbirds should be noted.

Biologists are frequently so enthusiastic about wildlife that when presented with the opportunity to study a riparian area, they immediately begin thinking of ways to census them. Although important, highly desirable, and needed, this is probably the last step that should be taken.

Approved standardized censusing technique for fauna will be used. The wildlife/habitat relationships are developed when good wildlife data is compared with good vegetation data within a homogenous land unit. The importance of censusing in *one* complex can not be over emphasized. The relationship of adjacent upland vegetation should also be taken into account.

2. **Monitoring**

A primary use of Level III riparian evaluation is for monitoring changes in riparian conditions. Data are derived in a manner which permits repeated measurement over time. Remeasurements provide defensible trend data and can be used to assess whether the goals for a particular riparian area are being reached.

a. **Aquatic Community Habitat**: Some suggested monitoring applications and techniques follow.

(1) **Cumulative Effects**: Two techniques are identified as possible means to assess cumulative effects and monitor trends in aquatic community habitat over time. They may be employed separately or in concert.

(a) **Bioassessment Survey**: Aquatic insect and fish community composition and relative species abundance can be effectively used to assess cumulative effects and trends in aquatic community habitat condition and water quality. GAWS Macroinvertebrate Survey procedures and data forms are referenced in R-4 FSH 2609.23.

(b) **COE Survey**: The COE survey approach of Hankin and Reeves (1989) is particularly well suited to assessing cumulative effects and monitor trends in aquatic community habitat over time. Data are collected over the entire complex (or over all the complexes in a watershed), are relational in nature and can be collected with known precision and accuracy. Select attributes that (1) are likely to be limiting production capabilities, (2) are likely to be influenced by management activities; and (3) have a "low" natural variability.

(2) **Site-Specific Effects**: A number of techniques may be used to assess site-specific effects and trends in aquatic community habitat over time. Among the most commonly employed technique is the GAWS Level III transect approach. General methods and data forms are referenced in Region 4 FSH 2609.23. For monitoring purposes, it is recommended that transect study sites encompass at least four stream meander cycles, and include 10 to 20 equi-distantly spaced transects. All transect locations should be "monumented" (i.e., staked and mapped).

Use of site-specific transect data to extrapolate changes in aquatic community habitat condition over larger areas such as riparian complexes or stream reaches should be done with caution. If such use is planned for the findings, it is important to complete a COE habitat survey of the entire area prior to location of the transects, to make sure that the monitoring site is representative of the larger area.

b. **Soils:**

Soils monitoring is conducted using soil data collected during Level II and III riparian evaluation. Soil factors commonly used are: soil puddling, changes in soil bulk density, presence of platy structure, amount of bare surface soil, extent of soil erosion, and area extent of present riparian soil as related to potential riparian area.

Implementation monitoring evaluates if soil conservation practices, reduced use, grazing management system change, or other soil enhancing practices were implemented as planned. It identifies needed changes in the Forest Plan implementation process and subjectively evaluates soil conservation practice application to determine if effectiveness monitoring is needed. The results of implementation monitoring will be documented and filed with project plans.

Effectiveness monitoring quantitatively measures how effectively soil conservation practices have limited detrimental changes in soil properties. A soil scientist who understands the relationships of soil conservation practices to various soil properties should be involved in effectiveness monitoring. Effectiveness monitoring can be designed to measure the beneficial effects of site restoration, site rest, grazing systems, reduced erosion as well as detrimental changes.

It is not possible to monitor effectiveness on all the different riparian complexes within a project area. Therefore, monitoring should be focused on the most critical soil qualities or most limiting riparian complexes within that project area. Results may then be extrapolated to other similar riparian complexes. Reliable high-quality data from a few projects is better than poor quality data from a larger number.

c. **Hydrology and Stream Dynamics:**

Some watershed level aspects of the riparian evaluation may not be directly monitored as part of riparian monitoring. For instance, changes in flow frequency would have to be intensively monitored over long time periods. Longitudinal channel morphology (meander amplitude and wavelength) does not lend itself to monitoring and changes may occur over long time periods.

The hydrologist should be involved in the ID Team evaluation of the implementation of management activities to see that stream and water quality protection measures are correctly applied.

(1) **Specific Water Quality Attributes**: Use EPA standard methods to monitor chemical, biochemical, and bacteriological parameters. Monitoring may be designed to define Forest-specific relationships between stream types and:

-sediment yields

-sediment transport characteristics - bedload vs. suspended sediment

-bank stability

-composition of hydric riparian species on the greenline

These monitoring designs may be data intensive and only a limited number of sites should be involved. These are considered as validation monitoring.

d. **Vegetation**: Repeated application of the techniques employed to determine vegetation characteristics for a complex (e.g., cross section composition, green line composition, and woody species regeneration surveys) provide the basis for assessing trends in vegetation condition over time.

e. **Terrestrial Habitat**: Repeated application of the techniques employed to determine vegetation characteristics for a complex provide the basis for assessing trends and management effects in terrestrial habitat condition over time.

Chapter 5 - MANAGEMENT APPLICATIONS AND INTERPRETATIONS

Chapter 5. MANAGEMENT APPLICATIONS AND INTERPRETATIONS

Procedures and guidelines in this section will facilitate the management application and interpretation of data collected during riparian evaluation. Methods of interpretation are advanced for single resources but are interrelated and should be used together when assessing the health of a given riparian area. As knowledge is gained about an individual kind of riparian complex, the reliability of extroplating management experiences will increase.

A. Aquatic Community Habitat

Level II Riparian Evaluation establishes mapable, ecologically based units known as "riparian complexes." By definition, complexes contain a single morphological channel type. It is believed that aquatic community habitat potential within complexes is reasonably homogeneous. This will facilitate assessment of land use effects, establishment of meaningful management objectives, and development of sound prescriptions to meet those objectives. Results from Level II Riparian-Aquatic assessments will:

- provide a general overview of aquatic community habitat within complexes;

- suggest broad relationships between the aquatic and terrestrial components of riparian habitats and the associated uplands; and,

- indicate possible management influences (by comparison with surveyed conditions in "reference complexes").

This information will, in turn, provide a basis for identifying and prioritizing needs for more intensive evaluation.

Level III Riparian-Aquatic assessments provide quantitative information on current conditions, ecological potential, relationships between aquatic and terrestrial ecosystems, ecological processes, and management effects. Level III surveys are to be designed to collect the data necessary to address specific questions. Some application examples include:

1. **Identifying/Quantifying Land Use Influence**

Identifying and estimating the magnitude of change in aquatic community habitat, induced by land management activities, generally relies upon applying one of two strategies. The first approach (one that is best suited to formal research) is to evaluate changes in riparian-aquatic conditions when various management activities and practices are introduced in pristine or near-pristine settings. This is the classic scientific approach in which conditions in one riparian complex are calibrated to a like-referenced complex during a pre-treatment period. Then only one of the complexes is treated while both are evaluated. Conditions in the untreated complex represent the "control" or natural environmental influences. Conditions in the treatment complex are then compared to the control; differences in condition represent changes due to management.

A second approach that Forests may more reasonably employ because it does not require long time periods for evaluation, relies upon the assumption that riparian-aquatic condition potential is consistent within riparian complexes. Using this approach, Forests first identify and characterize "reference riparian complexes" in areas that have not been or are believed to have been insignificantly influenced by management activities. Forests then use these reference complexes as the "standard" against which to measure that complex in settings influenced by management activities. It is important to keep in mind the limitations of this approach (i.e., assumed "representativeness," natural dynamic variability of individual riparian-aquatic ecosystem components (even) in pristine settings, etc.) Analysis of land use effects may address individual parameters or use similarity indexes such as the resource ratings discussed elsewhere in this guide.

2. Predicting Standing Crop of Stream Fish

Level III surveys can be used to collect information on the physical and biological parameters used in various models to predict standing crop of fish in streams. These models can be applied to reference complexes and complexes influenced by management activities. Fausch, et. al. (1988), provides a summary of models available to predict standing crop of stream fish from habitat variables.

3. Limiting Factors Assessment

In one sense, the models referenced above may be used to indicate the habitat variables limiting fish production. Another approach that may be employed involves identification of habitat requirements (stratified by species, season, and life stage), collecting data to quantify available habitat by that stratification, and balancing the seasonal/life stage needs and availability to identify likely habitat production bottlenecks. It is imperative that all assumptions used in this type of limiting factors assessment be fully documented.

4. Habitat Improvement Planning

As noted elsewhere, Level III surveys can provide information on potential and existing riparian-aquatic conditions, land use influences, and the environmental factors likely to be limiting the productivity of aquatic ecosystems. If riparian-aquatic conditions are not consistent with Forest objectives, this information is essential for identifying activities that may be implemented to achieve the objectives. The focus of these activities should be on dealing with management problems rather than on treating the symptoms of those problems. Often the key to maintaining or restoring healthy aquatic conditions is to maintain sufficient residual riparian vegetation biomass - particularly of hydric species immediately adjacent to the stream channel.

Instream structural improvements should be applied only after land use problems are addressed and only to the extent that they accelerate natural recovery processes and are necessary to meet management objectives. Information generated by Level III surveys for the various resource areas will be useful in project design.

B. Soils and Geomorphology

This section deals with basic interpretations and application of the soil and geomorphic data which is collected during Level II and Level III of the Integrated Riparian Evaluation processes. Geomorphology and soils information is generally contained in a soils report or furnished by the soil scientists. Basic broad soil map unit boundaries are drawn along the changes in material type. The kind of geology directly influences the rate of landscape evolution and the eventual kinds of drainage ways, valley bottom shapes, stream systems and riparian areas that develop in a given landscape.

The kind of geomorphology and soil parent material directly influences the properties and types of riparian complexes which occur in the landscape. The inherent properties of the bedrock and geologic parent materials relate directly to the soils and landforms in the riparian complexes. The particle size distribution and other soil properties result directly from the weathering of the parent materials. Coarse granites form coarse sands and relatively non cohesive soil materials while limestone parent materials may weather into fine textured cohesive materials. Changes in geomorphology and soil parent materials are used to delineate riparian complex boundaries in both Levels I and II evaluations. Stream gradients frequently change when parent material types change.

Materials which are stratified and contain a variety of material sizes will break down and erode with the forces of water more quickly than a fine textured cohesive clay. This effects streambank stability and erosion rates. For example, a stream bank with stratification of coarse sands and gravels overlain by fine silts and clay at

the soil surface will tend to undercut. The force of moving water will erode the non-cohesive layers at a more rapid rate and cause slumping of the surface horizons.

Soil properties such as texture, soil porosity, and available moisture capacity are used to identify the timing and duration of use that will have the least impact on the riparian resources. Fine textured soils with a high moisture content tend to compact readily.

1. Ground Water

Ground water depth and movement directly influence riparian area health. Availability of ground water determines in many cases the plant species composition. The presence, absence, or composition of hydric species is related to the depth of ground water. Ground water movement rates influence the concentration of oxygen in the water which in turn influences the riparian vegetation.

Different geologic and soil parent materials release and transmit ground water at different rates over time and effect the timing and duration of surface flow and water available to the riparian area. Aquatic habitat responds directly to ground water regimes. In any material type textural categories there are two variables; The amount of water the material will hold; and the rate at which water will move through the material.

Following are some generalized examples of ground water transmission rates

MATERIAL TYPES	*TRANSMISSION RATES*
Large stones, cobbles and gravels	rapid
Gravels and sand	moderate
Find sands and silts	slow
Clays	very slow

Clays may hold large amounts of water, however, they generally release the least amounts of water and at a slow rate.

2. Soil Erosion

Surface erosion rates are one very significant interpretation for management. From the Level II Riparian Evaluation, the major and dominant soil families are identified by composition for the complex. In Level III, they are mapped by location and composition for the complex. Surface soil erosion interpretations are made based upon bare soil conditions for the soils in the complex.

Surface soil erosion is important to the stream and the aquatic environment. Once the erosion enters the stream channel it is sediment. Increases in sediment usually impact the aquatic environment and may change the stream hydraulics. Effect of increases, or reductions of sediment levels in the stream are interpreted by the fisheries biologist or hydrologist. Erosion of riverine riparian soils is generally by channel bank erosion. However, severely degraded riparian areas may have little or no vegetation to buffer the highly erosive soils from channel or overland flows. High soil erosion rates may result.

Erosion reduces soil productivity potential, and if the amount of vegetation on the site is low, the existing productivity is very low or well below its potential.

For each soil family identified in Level II, a qualitative surface soil erosion statement can be made. Such qualitative terms are: high, moderate, and low. Soil families with compacted surfaces, weakly structured, low in coarse fragment content, of silty or sandy textures, and have fine texture subsoils or subsurfaces, have high erosion rates. Soil families with surfaces that have very friable, strongly structured, fine textures such as clay or clay loam, high coarse fragment content, with coarse textured subsoils or subsurfaces will have low erosion rates.

In the Level III evaluation, soil families or phases of soil families are refined and classified so that soil erosion K factors are assigned to them. By knowing location and extent of each component of the soil map unit, soil erosion rates can be quantitatively interpreted and accurate rates can be displayed for the users. Erosion rates are usually expressed in tons per acre per year. Erosion rates of 1-2 tons per year are low; 2-3 tons per year are moderate; 3-5 tons per year are high.

3. Compaction

Soils differ in their inherent ability to resist compaction. Important factors needing evaluation include: soil texture, soil structure, organic matter content, and rock fragment content. Soil compaction is highly significant in riparian soils. Soil compaction is an important factor that partially determines, productivity for plant growth, soil-water movement, and erodibility by water. Prolonged trampling by humans or animals can compact the soil surface to the same degree as mechanical equipment. This may determine the life of a recreation site. Trailing, paths, and continued presence of animals in wet and semi-wet soils are causes of compaction. Degree of compaction affects the vegetation species, lowers productivity, decreases soil moisture available for plant growth and causes flashy surface water runoff and erosion. The persistence of recognizable and detrimental compaction has been documented to last up to 40 years (Thomas, B. R., 1970 cite of Steinbrenner). Once compacted, soils need remedial management practices that may include disking or chiseling, or deep rooting plants, and rest.

Measuring soil compaction by use of the penetrometer gives only a relative indication of soil compaction. In order to gather meaningful data with the penetrometer, it is mandatory to have a control site for reference or baseline. Sometimes areas not compacted may be found under large shrubs or willows where animals or humans have been unable to move in or through. Readings from the penetrometer are expressed in tons per square foot. The pocket penetrometer is considered reliable only to approximately plus or minus 20 percent. Classes used are slight, moderate, or severe. Classes for the readings are: 0 to 1.5 is slight, 1.6 to 3.0 is moderate, and 3.1 to 5.0 is severe.

Using the soil bulk density data collected in the Level III evaluation procedure, a comparison of the existing and undisturbed or expected natural bulk density will indicate the extent this soil property has been effected. Generally, an increase in bulk density of 15 percent or more will be considered as detrimental. The susceptibility to compaction is most common in medium textured soils at moisture contents between 12-28 percent (by weight) and compactive forces estimated to be greater than 7 psi. (Harris, 1971).

Detrimental soil compaction that reduces vegetation will be interpreted by the soil scientists in conjunction with the speciality that it affects. If it is forage, a vegetation specialists should be involved in evaluating the effects and the range interpretations should reflect the reduction in species kind and amount.

4. Soil Productivity

Soil quality standards set threshold values where management induced changes in soil properties are likely to lower long term productivity. These standards are not established at this time for many management practices. However, the soil scientist may make some interpretation from an on-the-ground assessment of the soils in the riparian complex as to which are being lowered, or have been in the past, to the point that long term soil productivity is impaired.

In many cases, soil classification will provide the necessary interpretation for vegetative productivity potential. Soils that once supported a vigorous sedge cover and now support a bluegrass have exceeded the threshold value for optimum plant biomass. Soil families of the Aquolls, Aquents, Aquepts, Aquods, Aqualfs, are examples of the soils associated with water tables that are conducive to sedges or rushes. These soils are known to have high productivity potentials.

Soils in the Cumulic subgroups also have high and very high productivity potentials for many of the drier species of vegetation such as sagebrush and graminoids. Some of the these soil families have been monitored and have productivity ratings established on the uplands. Estimated and measured productivity of the riparian complex vegetation may be used to develop relationships for extrapolating these data to the riparian soils.

5. Extent of Riparian Areas

Little documentation or literature exists that discuss the identification and extent of past riparian areas. However, once soils have become mottled, or gleyed from water tables, these qualities exist or persist for many decades. Conversely, soils may become distinctively mottled in as few as three to five years of persistent water table.

By digging soil pits, across landscapes that are suspected to be past riparian areas the soil scientist can establish whether the soils show past evidences of mottling or gleying and therefore establish potential aerial extent of riparian areas by mapping the soil. Soils information is key in delineating the extent of riparian area; however, establishing the extent of the riparian area using both soil and vegetation information is the desired approach. Delineating the riparian area using existing riparian vegetation species may tend to reflect current use and condition rather than the true riparian area. Riparian areas are very small in area extent, and it is important to identify potential riparian areas that are not now growing riparian plant species. Good quality, small scale aerial photos and intensive transecting are the tools and methods for properly delineating the riparian area.

6. Potential Revegetation

Natural soils or soil materials have capability of supporting the growth of grass, shrubs, or trees in the riparian complex. Revegetation potential ratings are a relative rating suggestive of the number of successful seedings that might be expected during a given period of years. The ratings are based on soil properties which affect the establishment and growth of vegetation such as available water capacity , slope, depth to bedrock or cemented pan, shrink-swell potential, pH, water table depth, and moisture regime. Soil ratings are general, due to the different requirements of the individual species and the methods used for revegetation.

Probably the most critical factor limiting species is the water table depth in the soils. If the soils or site had a sedge species cover, and it doesn't now, one can interpret that past management has changed the soil qualities by lowering the water table, or dewatering the site. This means that to reestablish sedges on the site, favorable water table characteristics must be restored. This may be done by rest from grazing or recreation use, stream structures to raise the water table, or a combination of management and structural measures. Reestablishment of willows to a site is also very dependent upon having their roots in a water table most of the time. In these instances the depth to the soil water table may be the most important soil factor.

Other factors that require consideration are effective moisture, aspect, texture, temperature, and presence of a sod layer. These are site specific factors, which are interrelated and variable from site to site.

A rating system and table has been developed for non-riparian soils. This is in the "Soil Interpretative Guide, USFS, Region 4, Intermountain Region, Draft March 1985."

As a guide for rating the riparian soils the above referenced document may be used. A rating of ***Good*** indicates that a wide selection of plants may be successfully planted or seeded in seven or more years out of ten. A rating of ***Fair*** indicates that fewer plants are adapted and can be successfully planted or seeded in four to seven years out of ten. A ***Poor*** rating indicates that soils are generally not suited for planting or seeding. Seeding should only be considered under emergency circumstances, and seeding success will occur in about three years or less out of ten.

C. Hydrology

1. Rosgen Stream Types

The Rosgen stream type embodies a number of associated characteristics including geomorphology, stream channel and bank stability, stream energy and sediment transport properties, and floodplain and hillslope interactions. These characteristics are useful in making assessments and recommendations for improving hydrologic function and riparian habitat. Stream type information is extremely useful as a quick and easy index of inherent stability of various stream systems. For example, sand bed channels (C5 stream types) are inherently unstable, while cobble, boulder streams (i.e., B2) are inherently stable. Rosgen (1985. A stream classification system, North American Riparian Conference, Tucson, AZ) and Rosgen personal communication, 1991, has described the stream types in detail and provides information for making interpretations. See Appendix E. This information can be used as guidance for selecting fish habitat improvement structures that are compatible with each stream type. The following are two examples of interpretations made from Rosgen stream types.

Complex A Is Characterized by a B2 Stream Type. (Moderate gradient/cobble, boulder channel.) Without knowing anything else about the complex, a number of interpretations can be made. This is a moderate gradient, coarse textured stream that is considered inherently stable. It is probably in a narrow valley. Stream power is relatively high and sediment transport capability is high, although sediment input to the stream is low due to stable landforms. Banks are probably stable because of their high large rock content. The channel is moderately confined and will exhibit little lateral movement and meandering. The riparian area and floodplain are probably narrow. Interaction between the side slopes and the riparian area is common due to the proximity of slope processes. Pool habitat is not limiting so pool habitat structures would not be considered, however, if swpawning habitat is limiting, this stream provides excellent opportunities for gravel collecting structures.

Complex B Contains a C4 Stream Type. (Low gradient/gravel bed channel). This complex would be within a broad valley type where the stream is only slightly confined to unconfined in the valley, and has a well-developed meander pattern in the erodible gravel/sand valley materials. The stream is low gradient, therefore having low potential energy for sediment transport. Gravel bar development and meander migration are the main means of dealing with in-channel sediments. This channel type is inherently unstable and derives stability largely from vegetation protecting the stream banks. The broad floodplain functions to retard downstream movement of flood water and enhances the deposition of sediments within the complex. Hillslope processes are less likely to have direct effect on the stream channel because of the buffer created by the broad valley and terrestrial riparian vegetation. This stream type is energy limited when loaded with accelerated inputs of sediment. Increases in sediment to this channel will likely result in accelerated channel migration, bank instability, and meander cutoff. Downcutting may also result. Care should be exercised in selecting aquatic habitat improvement structures for this channel because of the inherent instability of the bed and banks.

Additional information from soils, vegetation, upland hydrology and hydrologic regime enables further interpretation concerning the sources of perturbations affecting the riparian complex and specifically the stream channel. The combined information enables the team to evaluate the ability of the riparian area to respond to riparian based management changes.

2. Bank Stability

Streambank stability is influenced by the particle size distribution and cohesion of the bank materials (soil), whether those materials are stratified or not, the relative erodibility of the bank and bed materials, the water and sediment regimes, and the stream side plant communities. All these factors should be used to assess existing channel and bank stability in relation to potential. Bank stability is important in riparian evaluations because eroding banks are a major source of sediment to streams. Sediment from accelerated bank erosion impairs water and aquatic habitat quality. An unstable stream channel will change position both horizontally and vertically in a short time period and could conflict with developments or activities. Potential stream bank cover for aquatic habitat is controlled by the associated characteristics of the stream type.

Riparian evaluations should not ignore the remainder of the watershed. The stream channel may be responding to downstream stimuli, such as base level changes. A base level change will result in the degradation or aggradation of the stream channel upstream. Channel and bank stability are influenced by changes in base level. Off-site inputs of sediment and streamflow also influence channel stability.

3. Flow Regime and Slope Hydrology

The flow regime influences the morphology of the stream channel. Ground water controlled streams, those where spring discharge rather than surface runoff provides nearly all the water inflow, generally have near constant discharge. This flow regime creates more stable channels compared to streams influenced by widely varying flow from snowmelt or rainfall.

Nonspring-fed stream channels have developed in response to discharges having predictable frequencies of occurrence. Management activities both within and outside of the riparian area can alter the frequency of the discharge events. An increase in the frequency of a particular high discharge can result in channel instability and morphologic changes. Discharge can be increased from vegetation conversion or removal and soil compaction, whether these occur inside or outside of the riparian area.

Slope hydrology affects flow regime. Several upslope factors influence how rapidly surface and subsurface water concentrates in the drainage system. Does the watershed contain large areas of bedrock outcrop or very shallow soils over bedrock? Is the bedrock massive or highly fractured or weathered? Are there large meadows, lakes, or reservoirs in the watershed above the riparian areas? Are hillslopes steep or gentle, long or short?

D. Vegetation

Vegetation serves numerous roles in riparian settings. It serves as a forage source, an element of habitat for birds, fishes, and mammals, it buffers the forces of water, filters out sediments and chemicals, and provides aesthetic variety. Without appropriate vegetation, riparian areas deteriorate, streambanks are more susceptible to erosion, sediment delivery to the channel may increase, and riparian dependent resources can be detrimentally impacted.

Since vegetation is a function of the overall climate, soil, and water features in an area, it can serve in conjunction with other information as a visual identifier of riparian complexes. The complexes, in turn, allow us an opportunity to evaluate existing versus potential riparian vegetation in a particular setting.

Level II vegetation evaluation involves a general, rapid assessment of the composition of community types in a riparian complex. A general feeling for the health of the vegetation in the complex can be gained from this assessment. Also, one can determine if more detailed vegetation measurements are warranted.

Level III vegetation evaluation involves several measurements designed to quantify the ecological status of a particular area or, to evaluate its potential for a specific use of that area (Resource Value Rating).

The "Cross-Sectional Composition" and "Green Line" measurements provide data to evaluate the amount of vegetation in a complex which may be indicative of disturbances. See Appendix A for field forms. Ratings can be calculated to determine ecological status or if the area is meeting or not meeting specific objectives. The "Woody Species Regeneration" measurements provide a quick idea of the amount and age of the woody vegetation found on the area. Certain kinds of species are desirable for their foraging, habitat, or channel stabilizing values. These measurements allow an evaluation of how well our current management is maintaining or supplying the appropriate species for these values.

E. Terrestrial Habitat

1. Within the Complex

Wildlife species/habitat relationships are made with meaningful vegetative descriptions. Fauna responding to both quality and quantity of their habitat. A good understanding of how vegetation responds to its environment and being able to properly describe it will allow managers to assess wildlife habitat and how and why different animal species use it.

The position of vegetation on the landscape produces a pattern that is called vegetative diversity. This pattern can be divided into vertical and horizontal aspects. Vertical diversity is structure created by layering (tiers) of vegetation, both within and between the same or different vegetation community(s). Horizontal diversity (edge) results from the number of different plant communities or successional stages that are adjacent or in close proximity to each other within the complex.

The generalization can be made that the taller (vertically) riparian plants can grow the greater the opportunity for vertical diversity. Also the greater number of different (horizontally) riparian plant communities that occur in a given area the greater the opportunity for horizontal diversity. Both contribute to greater animal species diversity.

Describing vegetation by (c.t.) is done as follows for vertical and horizontal diversity:

VERTICAL:

Trees:	% mature
	% poles
	% saplings
Willows:	% mature
	% young
Graminoids:	%
Forbs:	%
TOTAL =	100%

HORIZONTAL:

c.t.	1	-	%
c.t.	2	-	%
c.t.	3	-	%
c.t.	4	-	%
TOTAL=			100%

Approved standardized census technique for fauna will be used. The wildlife/habitat relationships are developed when wildlife data are compared with vegetation data within a homogonous land unit. The importance of census in *one* complex can not be over emphasized.

2. **Complex and Adjacent Uplands**

The greater the mobility of a particular wildlife species the more likely vegetation adjacent to the complex will play a significant role in understanding habitat quality.

An example of the need to understand this concept can be shown in the following: Compare a cottonwood/willow complex occurring in an otherwise sagebrush setting and trying to compare it to a cottonwood/willow complex in a conifer setting. The riparian complexes could be the same, but the adjacent upland vegetation is adding additional vertical and horizontal diversity in one setting, but not the other. The wildlife species/habitat relationships would not be the same although some commonalties would be expected. Use the same approach outlined in A, and develop an additional diversity rating for the adjacent uplands (both valley slopes).

The ratings give a degree of complexity for both vertical and horizontal diversity of riparian complexes. This rating is used to compare similarity of riparian areas to minimize extrapolation errors for species/habitat relationships for management implications else where.

3. **Beaver**

Beaver are an important and highly misunderstood part of many riparian environments. They are a riparian dependent species, using the riparian, and adjacent upland areas. Beaver are unique in that they modify their habitat which can cause changes in and adjacent to the riparian area.

Some generalizations about the habitat quality and quantity needed by a beaver colony can be made in mid (5000') to high (8000') elevation riparian areas. A colony is considered to be two to seven beavers.

The following is an estimate of the amount (ac.) of habitat needed to maintain a beaver colony.

In complexes with willow *without* adjacent aspen in the uplands:

High composition (>40%) of willows	-	12 acres
Medium composition of willows	-	18 acres
Low composition (<10%) of willows	-	25 acres

In complexes with willow *and* adjacent aspen within 100 yards of riparian area; consider both sides of riparian area.

High quality aspen	-	4 acres, 3"-12" dia.
Medium quality aspen	-	6 acres
Low quality aspen	-	8 acres <3" or>12"

Stream gradient is another factor in beaver habitat. Beaver prefer dam sites where stream gradients are between 1 percent and 6 percent. As the gradient increases the quality of the habitat decreases. The higher quality habitat occurs on streams with less than 3 percent gradient.

Using the concept outlined in E. 1 and E. 2, the carrying capacity for beaver can be estimated in different riparian areas. Beaver and livestock can be in direct competition for food (woody and herbaceous) depending on the status of the riparian area. If no management objectives for the riparian areas exist, unresolved conflicts between beaver and other resource activities may continue.

4. Resource Survey Methods, Cross-Section Composition

Information relating to wildlife habitat may be collected while doing the cross-section composition. Number of steps of woody species can be recorded on the cross-section form under the appropriate columns (sprout, young, mature, etc.). An estimate of average height of each age class also is recorded on this form. A Subsequent evaluation can then be made regarding wildlife habitat characteristics within the complex.

F. Riparian Resource Rating

1. Aquatic Community Habitat

The aquatic community habitat resource condition rating is based on a combination of variables commonly evaluated by Level III riparian surveys. The rating includes habitat features which often limit salmonid reproduction, rearing and overwintering and are susceptible to being modified by riparian area use. The user may choose all or a sub-set of these habitat features in developing an aquatic community habitat rating for local application. Protocols for data collection are referenced in Appendix H.

Sample aquatic community habitat parameters include:

a. **Maximum Yearly Temperature**

b. **Biotic Index of Organic Enrichment**

c. **Bankfull/Low Flow, Cross-Sectional Area Ratio**

d. **Portion Streambank Stable**

e. **Portion Streambank Undercut**

f. **Portion Streambank with Overhanging Terrestrial Vegetation**

g. **Portion Low Flow Stream Area as Pool**

h. **Pool Complexity**

i. **Habitat Diversity**

j. **Substrate Sedimentation**
   (1) **Spawning Habitat - Percent Fines**
   (2) **Rearing/Overwintering Habitat - Interstitial Space Index**
   (3) **Food Production Areas - Interstitial Space Index**

The aquatic community habitat resource condition rating is used to relate existing conditions to the potential for the complex, given its ecological setting. "Potential" values for habitat parameters are estimated by sampling "reference complexes" within the same ecologic setting, and which have been influenced by land use activities as little as possible. If no such sites are available, extrapolation from settings approximating the potential may be necessary. Figure 5 contains an example aquatic community habitat resource condition rating.

General descriptors of condition may be assigned to ranges of resulting numerical values (e.g. "excellent" = 90+, "good" = 80-89, "fair" = 70-79, and "poor" = 69 or less), but these descriptors should be considered SUBJECTIVE until relationships between the condition rating and fish production have been defined.

Figure 5. Example of Salmonid Habitat Resource Condition Rating for second order, C-channel streams flowing through a very low, gradient, broad- bottomed, trough like valley (i.e., Valley Bottom Type 3140), in granitic parent material.

Habitat Parameter	Reference Condition	Existing Condition	Conditions Relative to Reference
Maximum Temperature	< 16 C	14 C	100[1]
Biotic Index	50	50	100[2]
Bankfull/Low Flow Ratio	3	5	33[3]
% banks stable	90	60	66[2]
% streambank undercut	30	10	33[2]
% streambank w/ovrhng veg	70	20	29[2]
% low flow stream area pool	60	50	83[2]
Pool Complexity Index	90	30	33[2]
Habitat Diversity Index	80	40	50[2]
Substrate sedimentation (for most limiting habitat)			
1) spawning 2) rearing/overwintering 3) food production areas	20	50	0[3]
TOTAL			527

Aquatic Community Habitat Resource Condition Rating = 527/10 = 53

[1] Enter 100 for max existing temps < 16 C; 0 for max temps > 16 C.

[2] [Existing/Reference] x 100 (not >100, or <0): **use this formula for habitat parameters whose values get *smaller* with decreasing habitat condition.**

[3] {[(2 x Reference)- Existing]/ Reference} x 100 (not >100, or <0): **use this formula for habitat parameters whose values get *larger* with decreasing habitat condition.**

2. Calculating Ecological Status and Resource Value Ratings

a. **Calculating Ecological Status:** There is a strong correlation between latter stages of succession in riparian areas and the overall health of these areas, as well as the values they provide. We must maintain a high enough ecological status in these areas that the basic compoments of soil, vegetation, and water can interact together in a postiive way.

Ecological status is used to relate the degree of similarity between current vegetation and potential vegetation for a site. It can be measured on the basis of species composition within a particular community type or on the basis of community type composition with a riparian complex. The categories for ecological status include: very early seral, early seral, mid seral, late seral, and potential natural community(ies) (PNC) based on the degree of similarity to the potential natural community. Similarity between the present vegetation and the PNC can be calculated by a coefficient of similarity ($2w / a+b$) where a is the sum of species values for measured factors of present vegetation, b is the sum of values in the PNC, and w is the sum of the values common to both (Range Inventory Standardization Committee 1983). Composition values for the species or PNC's must be obtained by sampling sites in as natural a condition as possible. If no representative undisturbed areas are available, extrapolation of composition from ecological setting approximating the PNC may be necessary. Only those species or community types known to be native to a particular ecological setting may be used for establishing PNC values. See Figure 2 and related discussion, and Appendix I for examples of calculating ecological status and green line stability.

A "Stability Class" value also has been assigned to each community type in the Region 4 listing. This value ranges between 1-10 and reflects the relative degree to which each community type is able to bind soil and buffer the effects of moving water against streambanks.

A "Stability Rating" is obtained by multiplying percent composition of each community type by the "Stability Class" value. Ratings for each type are then added to obtain an "Index" for the area being measured. This "Index" is then assigned a descriptive" Stability Rating" (poor, moderate, etc.) by relating the calculated value to a 1-10 scale (see Example-Stability Rating, Appendix I).

Additional factors such as ground cover, soil compaction, streambank breakage, or channel form may be used to refine ecological status. These values will likewise be based on percentage of similarity to values obtained in an undisturbed setting.

b. **Resource Value Ratings**: We often choose to manage vegetation for some seral stage other than PNC. In these cases, another approach used to evaluate status or condition of riparian areas is to compare the present species or community type composition of an area to a desired set of species or community types capable of occurring in that area. On public lands, the "desired values: are developed by professionals in an interdisciplinary setting. Similarity values between "present" and "desired" are calculated using a process similar to that used in developing ecological status ratings. Categories for rating the site are poor, fair, good, and excellent as in past range condition ratings. Or, categories can be developed to determine whether the site is or is not meeting management objective. Information from the Range Inventory Standardization Committee Report (1983) suggested that a value of 75 percent similarity or greater may be used to differentiate between meeting and not meeting management objectives.

3. Streambanks

The term "streambanks," as used in this guide, refers to "the steepest portion of the channel bottom from the mean channel bankfull level to the mean low waterline (or baseflow water surface elevation)."

A variety of Level III survey procedures may be used to partition total streambank length into four vegetation/ stability types. The types include vegetated/stable, unvegetated/stable, vegetated/unstable, and unvegetated/unstable. Definition of these types is provided in the description of Level II Riparian-Aquatic

surveys and in the glossary. The same methods may be applied to identify the percent of total bank length that is undercut and the percent of bank length supporting overhanging terrestrial vegetation. Primary techniques used to gather this information include the "paced line" procedure as outlined for vegetative green line surveys in this guide and the calibrated ocular estimation technique described in Appendix H for Level III riparian-aquatic inventory.

The streambank resource condition rating is used to relate the degree of similarity between existing bank conditions and potential bank conditions for the ecological setting. Streambank information can be used for several different ratings. Figure 6 presents a example of streambank stability rating that is based on streambank features significant to erosion and potential sediment production. Factors which affect stability include the presence and kind of vegetation, the kind of bank materials and the condition of the bank i.e., tension cracking and sloughing and other factors. In this rating the stability criteria is applied to the streambank as viewed along the steepest sloped portion of the channel between the bankfull and existing waterline.

Figure 7 presents a sample streambank rating that utilizes three bank features generally important to salmonid stream fishes, and often influenced by land-use activities. The features are streambank stability (excluding the portion of stable streambanks without vegetation), undercut banks, and overhanging terrestrial vegetation.

Values for "potential bank conditions" are estimated by sampling "reference complexes" within the same ecological setting, and which have been influenced by land use activities as little as possible. If no such sites are available, extrapolation from settings approximating the potential may be necessary.

General descriptors of streambank condition may be assigned to ranges of resulting numerical values (e.g., "excellent" = 90+, "good" = 76-89, "fair" = 68-75, and "poor" = 67 or less), but these descriptors should be considered SUBJECTIVE until relationships between the bank condition rating and fish production have been defined.

Figure 6. Example of Streambank Stability rating using coefficient of similarity. Based on stream bank features significant to erosion and sediment production.

Streambank Type	Potential Composition	Present Composition	Amount in common
Vegetated-stable	80	40	40
Unvegetated-stable	5	15	5
Vegetated-unstable	7	20	7
Unvegetated-unstable	8	25	8
	a=100	b=100 condition = poor	w=60

$2w/a+b = (2\ (60))/100 + 100 = 0.6$

Similarity to Potential condition %	Streambank rating
0 - 60	Poor
61 - 75	Fair
76 - 90	Good
90+	Excellent

Figure 7. Sample streambank resource condition rating, based on three bank features significant to salmonids and often influenced by land-use activities. Composition is expressed as a percent of total streambank.

Condition Streambank Type	Reference Composition	Present Composition	Relative to Rfrnce
Vegetated-stable	90	70	78[1]
Undercut	40	30	75[1]
With Overhanging Vegetation	60	20	33[1]
TOTAL 186			

Streambank Resource Condition Rating = 186/3 = 62

[1] [Existing/Reference] x 100 (not >100, or <0): **use this formula for habitat parameters whose values get *smaller* with decreasing habitat condition.**

Another useful way of evaluating streambank conditions requires collection of bank stability data by green line community type. Within soil types, community types appear to have "inherent" capabilities to provide stability to streambanks. When bank stability data are collected by community type, two types of management activity influences can be examined. The first level of analysis addresses how management activities may have changed "streamside" vegetative community types (and, therefore, existing bank stability potential). The second level of analysis addresses how management activities have reduced the inherent bank stabilizing ability within community types (e.g., through reduced plant vigor, etc.). Using this approach, the amount of increased bank instability attributable to land use effects may be more effectively estimated. Appendix I contains a table listing stability factors by vegetation community types for the Intermountain Region.

Chapter 6 - RIPARIAN DATA FILE (Reserved)

Chapter 6. RIPARIAN DATA FILE

(Reserved)

Chapter 7 - GLOSSARY

GLOSSARY

Apparent Trend An estimate of trend drawn from the presence or absence of indicators noted or measured during a one-time observation.

Aquatic Community Habitat The physical, chemical, and biological attributes influencing species compositions and abundance in aquatic ecosystems.

Aquatic Ecosystems The stream channel, lake or estuary bed, water, biotic communities, and the physical, chemical, and biological features that occur therein forming an interacting system that interacts with associated terrestrial ecosystems.

Aquatic Community Habitat Condition A quantitative description of condition classes for aquatic community habitats. An example follows:

Excellent Fish production is at least 90 percent of the estimated potential production capability (on the basis of geologic parent material and aquatic habitat type/stream channel type). Macroinvertebrate biotic condition index (BCI) is 90 or greater. Macroinvertebrate populations are dominated by clean water taxa. Sediment and/or organic, enrichment-tolerant taxa are represented in low numbers. Habitat condition index and/or streambank stability is at least 90 percent of the estimated potential (on the basis of the inherent capability of the stream-side potential natural communities to protect the streambanks from erosive stream flows).

Good Fish production is 70 to 89 percent of the estimated potential production capability. Macroinvertebrate BCI is 80 to 89. Sediment and/or organic, enrichment-tolerant taxa are present. Some clean water taxa are prevalent; however, the most sensitive taxa may be absent, or if present, are at depressed levels. Habitat condition index and/or streambank stability is 70 to 89 percent of the estimated potential.

Fair Fish production is 45 to 69 percent of the estimated potential production capability. Macroinvertebrate BCI is 70 to 79. Sediment and/or organic, enrichment-tolerant taxa are a prevalent component of macroinvertebrate populations. Clean water taxa are present, but at depressed numbers. Habitat condition index and/or streambank stability is 45 to 69 percent of the estimated potential.

Poor Fish production is 44 percent or less of the estimated potential production capability. Macroinvertebrate BCI is 70 or less. Macroinvertebrate populations ar dominated by sediment and/or organic, enrichment-tolerant taxa. Clean water taxa are essentially absent or represented in very low numbers. Habitat condition index and/or streambank stability is likely to be 45 percent of less of the estimated potential.

Bankfull Channel The bankfull channel is defined as that portion of the channel within the bounds of perennial streamside vegetation, as typically defined by the mean annual high flow. When determining bankfull channel width, the portion of "islands" with perennial vegetation are excluded.

Bankfull/Low Flow Ratio An index to average annual streamflow variation calculated by dividing the cross-sectional area of the bankfull channel by the cross-sectional area of the existing (low flow) water column.

Best Management Practices (BMP) A practice or combination of practices that are the most effective and practical means of preventing or reducing pollution from nonpoint sources.

Biotic Condition Index (BCI) Is an index of the biological condition of waters based on macroinvertebrate species numbers, biomass, and diversity.

Biotic Index Any of several indices of biological impairment of the benthic community indicating organic enrichment using macroinvertebrate community composition, production, and relative abundance of sensitive and tolerant taxa.

Boulder A streambed substrate particle greater than 12 inches, but no larger than 36 inches along the intermediate axis.

Channel Confinement The relationship of the width of the floodplain to the width of the channel.

Channel Entrenchment The degree to which the stream channel is cut into the surrounding floodplain.

Climax The highest ecological development of a plant community capable of perpetuation under prevailing climate and soil conditions.

Cobble A streambed substrate particle greater than 6 inches, but no larger than 12 inches along the intermediate axis.

Community Any assemblage of populations of plants and/or animals in a common special arrangement.

Community Type An aggregation of all plant communities distinguished by floristic and structural similarities in both overstory and undergrowth layers. A unit of vegetation within a classification.

Composition Relative percentage of a biotic (e.g., plant species) or abiotic (e.g., gravel substrate) feature present for a given area.

Cover/Forage Ratio The ratio of cover (usually trees & tall shrubs) to open foraging areas.

Cover, Percent The area covered by the combined aerial parts of plants and vegetative ground covering expressed as a percent of the total areas.

Density Numbers of individuals or stems per unit area. (Density does not equate to any kind of cover measurement).

Diversity The distribution and abundance of different plant and animal communities.

Ecological Site A kind of land with a specific physical site characteristics differing from other kinds of land in its ability to produce vegetation and to respond to management.

Ecological Status The present state of vegetation and soil protection of an ecological site in relation to the potential natural community for the site. Vegetation status is the expression of the relative degree to which the kinds, proportions, and amounts of plants in a community resemble that of the potential natural community. Soil status is a measure of present vegetation and litter cover relative to the amount expected if the potential natural plant community was present.

Ecosystems An interacting system of organisms considered together with their environment.

Embeddedness The degree that larger substrate particles (gravel, rubble, cobble, boulder) are surrounded or covered by sand/silt.

Fluvial Pertaining to or produced by the hydro-geomorphic action of flowing water.

GAWS (General Aquatic Wildlife System) A collection of survey methods to evaluate streams, lakes, instream flows, and macroinvertebrate communities. These methods are documented in an Intermountain Region Handbook Supplement (FSH 2609.23).

Gently Sloping Bank Banks with a bank angle greater than 135 degrees (as measured between the water surface and a line running from the base of the bank to the upper portion of the bank) are considered to be gently sloping.

Geomorphological Setting Physical features associated with a riparian area. In riparian areas they may influence the presence or absence of plant communities. Examples are: stream gradient, elevation, parent material, stream size, valley bottom width, and other factors. See "Riparian Community Complex."

Glide A portion of the stream with moderate to swift velocity and without surface agitation (i.e., displays laminar or near laminar flow patterns). Tails of pools are often confused with glides. Pool tails upstream of the pool tail crest are to be evaluated as part of the pool, not as a separate glide habitat.

Gravel A streambed substrate particle greater than 0.1 inch, but no larger than 3 inches along the intermediate axis.

Green Line The first perennial vegetation from the water's edge. Riparian areas that are in high seral status with stable stream banks will exhibit a continuous line of vegetation at the bankfull discharge level. Rocky stream types may have a significant amount of rock causing breaks in the vegetation. This rock is considered part of the green line. Other breaks may occur in the first perennial band of vegetation (watercourses or bare ground). The amounts of these (perennial vegetation, rock, and bare ground) should be recorded.

Habitat Attribute Selected physical, chemical, or biological environmental features to be inventoried or monitored.

Habitat Improvement Two general types of habitat improvement may be recognized. The first is "rehabilitation" or "restoration," where existing habitat conditions are manipulated through management activities toward the conditions inherent of the ecological setting. The second type of habitat improvement is "enhancement." Enhancement is accomplished by manipulating environmental features through management activities to improve the productivity for a particular species or species group beyond that which the ecological setting could naturally produce.

Habitat Type The aggregate of all areas that support or can support the same primary vegetation at climax.

Horizontal Diversity The distribution and abundance of different plant communities or successional stages or both across an area of land. This is commonly referred to as edge effect.

Hydric Soil A soil that is saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation.

IEH - Soil Erodibility Index and Topographic Hazard The five inherent erosion hazard class ratings together with a description of sites limitations are as follows:

1. ***Low*** - No appreciable hazard of erosion.

2. ***Mod. Low*** - Sufficiently resistant to erosion to permit exposure of bare soil under minimal precautionary restrictions.

3. ***Moderate*** - Sufficiently resistant to erosion to permit limited and temporary exposure of bare soil during development or use.

4. ***Mod. High*** - Unprotected bare soil will erode sufficiently to severely damage productive capacity of the soil or will yield excessively high volumes of sediment.

5. ***High***

Inherent Erosion Hazard Rating Method (IEH) IEH is based on the Soil Erodibility Index and the Topographic Hazard.

Inherent Streambank Stability The expected natural streambank condition for a given type of soil-bank material and vegetation.

Key ID A coding system for assigning a unique alpha-numeric descriptor to each riparian complex. This identifier will track the complex through any computer data files that are generated on the Forest, Region or inter-Regionally.

Larger Boulder A streambed substrate particle greater than 36 inches along the intermediate axis.

Map Unit A unit of land within a riparian area where specific data is collected.

Monitoring (kinds) (Reference FSH 1901.12; Chapter 6).

Implementation Monitoring

Effectiveness Monitoring

Validation Monitoring

Compliance Monitoring (See Water Quality Monitoring Handbook).

Mottling Variation of coloration in soils as represented by localized spots or blotches of contrasting color. Commonly develops under alternating wet and dry periods with associated reduction and oxidation environments. Mottling generally indicates poor aeration and impeded drainage.

Overhanging Vegetation To be counted as overhanging vegetation, terrestrial vegetation (living or dead) must hang over the water at least 1 foot beyond the bank edge and be within 1 foot of the water surface. Time of sampling in relation to season and use should be documented.

Pool A portion of the stream with reduced current velocity (average velocity is generally less than 1 foot per second), and often (but not always) with water deeper than the surrounding areas.

Potential The term is used interchangeably with the term "inherent." It indicates the expected natural conditions for a particular ecological setting.

Potential Natural Community (PNC) The biotic community that would become established if all successional sequences were completed without interferences under the present environmental conditions.

R-1 Channel Stability Evaluations A survey method to measure the resistive capacity of stream channels to the detachment of bed and bank materials and provide information about a stream's ability to recover from potential changes in flow or increased sediment. See "Stream Reach Inventory and Channel Stability Evaluation," 1978, published by USDA Forest Service, Region 1.

Reference Complex Riparian areas that represent, or best approximate, the potential of a particular ecological setting are referred to as "reference complexes." The environmental conditions measured at reference complexes form the basis for comparison for monitoring.

Riffle A portion of the stream where water flows swiftly over completely, or partially, submerged obstructions to produce surface agitation.

Riparian Areas Geographically delineable area with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems. Riparian areas may be associated with lakes, reservoirs, estuaries, potholes, springs, bogs, wet meadows, muskegs, and ephemeral, intermittent, or perennial streams.

Riparian Community Type A repeating, classified, defined, and recognizable assemblage of riparian plant species.

Riparian Complex A unit of land consisting of biotic and abiotic factors, which is identified by changes in geomorphology, landform, soil, stream gradient, and vegetation. The basic map unit in the riparian evaluation process.

Riparian Dependent Resources These are resources that owe their existence to the riparian area.

Riparian Ecosystems A transition between the aquatic ecosystem and the adjacent terrestrial ecosystem identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

Riparian Management Categories A value class assigned to streams as part of the stratification process. An example of Category I (of five categories) for the Sawtooth NF is shown below:

Category I Highest value riparian area (meet *any* of the listed criteria).

1. Associated with a highest value fishery habitat.
2. Associated with an outstanding value recreation resource.
3. Associated with highly unstable streambeds and banks.
4. Associated with municipal watersheds or research natural areas.

Riparian Potential Riparian definitions developed by each Forest that represent a point in development in relationship to the assumed potential of the riparian dependent resources and values i.e., vegetation, soil, streambank stability, water quality, and aquatic habitat for the riparian complex: examples are shown below:

Class I Potential key herbaceous and woody species in the riparian complex are present, reproducing, and in good vigor. Cover of key species is 90 percent or greater of estimated potential. Soil productivity has not been significantly reduced, as evidenced by no more than 10 percent reduction in macropore space from estimated potential. Streambank stability is at least 90 percent of estimated potential. Fish production is at least 90 percent of estimated potential.

Class IV Potential key woody species in the riparian complex are absent, or present only in remnant or trace amounts, and not successfully reproducing. Potential key herbaceous species are present and reproducing at 25 to 44 percent of their estimated potential. Ground cover is 26 to 44 percent of estimated potential. Soil productivity is substantially reduced, as evidenced by a 20 percent or greater reduction in macropore space from estimated potential. Streambank stability is 26 to 44 percent of estimated potential.

Riparian Vegetation Plant communities dependent upon or tolerant to the presence of free or unbound water near the ground surface (high water table).

Rubble A streambed substrate particle greater than 3 inches, but no larger than 6 inches along the intermediate axis.

Sand/Silt A streambed substrate particle .1 inch along the intermediate axis or smaller.

Sensitive Species Plant or animal species which are susceptible or vulnerable to activity impacts or habitat alterations. Species for which little habitat needs information is available may also be listed as "sensitive."

Seral Condition The unique characteristics of a biotic community which is a developmental transitory stage in an orderly ecologic succession involving changes in species, structure, and community processes with time.

Shore Depth Shore depth may be examined from two perspectives. Bankfull shore depth is an estimate of the water depth at bankfull flows immediately adjacent to the edge of the bankfull channel. Water shore depth is existing water depth (generally taken at summer low flow conditions) at the water's edge (or at the bank in the case of a wetted undercut bank).

Sinuosity Ratio of channel length to valley length.

Stable Streambank A stable streambank shows no evidence of active erosion, shearing, tension cracking, breakdown, or sloughing. Undercut banks are considered stable until tension cracks show on the ground surface at the back of the undercut.

Streambank As used in this Guide, "streambanks" represent the steepest portion of the channel bottom from the mean bankfull channel level to the mean low, or baseflow, water surface elevation. This typically occurs at the bankfull width.

Streambed The surface of the channel lying within the bounds of perennial streamside vegetation, as typically defined by the mean annual high flow. In other words, the streambed represents the surface of the bankfull channel, whether wetted or not.

Streamflow Variation The ratio of bankfull to base (or low) flow conditions, as determined by dividing bankfull cross-sectional area by existing (low flow) wetted cross-sectional area.

Stream Margin The water's edge.

Stream Meander Cycle One full cycle of typical hydraulic units (i.e., one pool and one riffle/glide). A stream meander cycle generally occurs over a stream distance equal to 5-7 times the bankfull channel width.

Stream Reach A designated section of a stream at which monitoring is conducted and hydrologic and/or fishery predictions are made.

Stream Section A subdivision of a stream segment representative of stream conditions within a riparian complex. Stream sections are to be at least one-fifth stream meander cycle in length. Five sections make up a representative segment when employing the "Representative Segment Estimate" approach to Level II Riparian-Aquatic Inventory.

Stream Segment A distance of stream that is at least one stream meander cycle in length. Using the Level II "Representative Segment Estimate" approach, it is to represent stream conditions within a riparian complex. Using the Level II "Multiple Sample Estimate," stream segments are the sample unit and five non-contiguous segments are characterized per complex.

Stream Type Rosgen (1985 and 1991-personal communication) A stream Classification System based on a combination of stream gradient, sinuosity, width/depth ratio, channel materials, entrenchment, confinement, and soil/land/form.

Sub-Area The first (i.e., most broad) division of riparian areas into more or less homogeneous units. This division is based on broad geomorphic considerations such as major geologic types, major topographic changes, soil family, etc. Management considerations such as allotment boundaries, wilderness areas, management categories, etc., should not be used in the delineation of sub-areas but, should be identified as land use sub-divisions or boundaries in the mapping and final coding for management areas.

Substrate The mineral particles lying on the surface of the streambed. Typically, six substrate classes are recognized: sand/silt, gravel, rubble, cobble, boulder, and bedrock. Occasionally the substrate is composed of decaying organic material, in which case it can be accounted for separately or in the sand/silt category.

Successional Stage The relative position of plant community development in relationship to the climax (potential natural) community, typically referred to as early-, mid-, late-seral, or climax (potential natural) communities.

Undercut Bank Banks with a bank angle less than 90 degrees (as measured between the water surface and a line running from the base of the bank to the upper portion of the bank) are considered undercut. For all undercut banks, a protrusion of the upper portion of the bank overhangs the water surface at a flow equal to or less than bankfull.

Unstable Bank The streambank shows evidence of active erosion, shearing, tension cracking, breakdown, and/or sloughing. Undercut banks are considered unstable if tension cracks show on the ground surface at the back of the undercut.

Unvegetated Bank Bare or essentially bare ground is considered unvegetated. If any vegetation is present, it is limited to sparse annual forbs. If the bankfull flow meets a steep or undercut bank below the rooting depth of the vegetation that occupies the top of the bank, it is considered unvegetated.

Valley Bottom Type A four digit code that describes the topography through which the stream is flowing or the meadow occupies. This code includes the valley shape, gradient, width, and the steepness of the side slopes. See Appendix D for codes.

Vegetated Bank The point where the bankfull flow meets the streambank is occupied with vegetation (crowns or roots).

Vertical Diversity The complexity of the above ground structure (tiers) of the vegetation.

Water Width Water "width" includes the length of the water surface perpendicular to flow plus the distance beneath wetted undercut banks. All "islands" are excluded.

APPENDIXES

APPENDIXES

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Appendix A - RIPARIAN DATA SHEETS

APPENDIX A

RIPARIAN DATA SHEET (Level I)

Date: _____/_____/_____

Subarea ID _____

Riparian Management Category _____ NFS Watershed No. _____

Name _____ Quad Name / No. _____

ENVIRONMENTAL / GEOMORPHIC SETTING

_____Lacustrine (lakes, ponds, reservoir) _____Riverine (streams, rivers, etc.)

_____Meadow _____Other (seeps, bogs, etc.)

Specify: _____

Remarks _____

_____

_____

PHYSICAL LANDSCAPE

Geologic Parent Material _____ Valley Bottom Type _____

Aspect Elevation Range _____ _____

Lower Upper

Size: Length _____Miles Area _____Acres

Landform Characteristics _____

_____

Soil Map Unit Nos. _____

RIVERINE GEOMORPHOLOGY (if applicable)

Stream Order _____ Sinuosity _____ Gradient _____%

Dominant Substrate _____ Stream Type (Rosgen) 1985_____ 1991_____

DOMINANT RIPARIAN VEGETATION (check one)

_____Conifer _____Deciduous _____Shrub _____Herb / Graminoid _____Non-vegetated

Remarks _____

_____

_____

RESOURCE RATINGS (Level I)

	CONDITION	VALUE CLASS	SENSITIVITY
Riparian Components			
Vegetation Source / Basis	_____ _____	_____ _____	_____ _____
Soil Source / Basis	_____ _____	_____ _____	_____ _____
Water Quality Source / Basis	_____ _____	_____ _____	_____ _____
Other Source / Basis	_____ _____	_____ _____	_____ _____
Habitat			
Fisheries Source / Basis	_____ _____	_____ _____	_____ _____
Wildlife Source / Basis	_____ _____	_____ _____	_____ _____
Other (specific species) Source / Basis	_____ _____	_____ _____	_____ _____
Other (specific species) Source / Basis	_____ _____	_____ _____	_____ _____
Uses			
Recreation Source / Basis		_____ _____	_____ _____
Administrative Designation Specify Designation		_____ _____	
Livestock Source / Basis		_____ _____	_____ _____
Other (specify) Source / Basis		_____ _____	_____ _____
Other (specify) Source / Basis		_____ _____	_____ _____

Remarks _____

_____

_____

_____

RIPARIAN COMPLEX DATA SHEET (Level II)

Key ID: R___ FO___ D___ YR___ subarea_____ complex_____

COMPLEX NAME _____

Waterbody name _____

District _____ Date _____ Quad name or # _____

Geologic parent material _____ Aspect _____

Valley bottom type _____ Stream type (Rosgen) 1985_____ 1991_____ Stream gradient _____%

Elevation: downstream elevation _____ft. Upstream elevation _____ft. Mid elevation _____ft.

Size of complex: Length _____ft. Width _____ft. Area _____acres

Soil Family	% Comp	Compaction
_____	_____	Sl / Md / Sv
_____	_____	Sl / Md / Sv
_____	_____	Sl / Md / Sv

ADJACENT (non-riparian area) UPLAND VEGETATION; LOOKING DOWNSTREAM

Left _____ Right _____

VEGETATIVE DESCRIPTION; DOMINANCE BY COMMUNITY TYPES

c.t. name	% of complex	estimated potential c.t. name

Successional status: PNC_____ Late_____ Mid_____ Early_____ Very Early_____

Apparent forage trend _____

Estimated forage production _____lbs.

BEAVER # caches in active ponds _____ # active dams _____ # inactive dams _____

GREEN LINE (Hydric) _____% **PHOTO ID:** _____

LAND USE ACTIVITIES AND ESTIMATED INFLUENCE ON RIPARIAN AREA

LIVESTOCK S&G	LIVESTOCK C&H	MINING	TIMBER	ROADING	RECREATION	ORV	OTHER
____	____	_____	_____	_____	_____	_____	_____

SPECIES LIST

Trees

Shrubs

Graminoids

Forbs

RIPARIAN AQUATIC DATA SHEET (Level II)

Method: Single Ocular_____, Representative Segment_____, Multiple Sample_____

POOL ATTRIBUTES	1	2	3	4	5
% Area in pools					
% Pool area made up of pools >2' deep					
AQUATIC VEGETATION					
% Streambed with filamentous algae					
% Stream margin with rooted aquatic					
BANK TYPE AND VEGETATION OVERHANG: Ocular_____ Paced_____					
% Bank length undercut (<90°)					
% Bank length gently sloping (>135°)					
% Bank length with overhanging veg.					
BANK CONDITION: Ocular_____ Paced_____					
% Bank length vegetated, stable					
% Bank length unvegetated, stable					
% Bank length vegetated, unstable					
% Bank length unvegetated, unstable					
Average % Vegetated, Stable_____ Estimated Potential % Vegetated, Stable_____					
CHANNEL MORPHOLOGY (XXX.X feet or meters - circle unit of measure)					
Bankfull: width					
: max depth					
: shore depth (L/R)	/	/	/	/	/
: bankfull channel shape					
Water : width					
: max depth					
: shore depth (L/R)	/	/	/	/	/
: wetted channel shape					
SUBSTRATE COMPOSITION					
% Sand/Silt (< .1")					
% Coarse fines (> .1-.25")					
% Gravel (.25-3.0")					
% Rubble (> 3.0-6.0")					
% Cobble (> 6.0-12.0")					
% Boulder (> 12.0-36.0")					
% Lg. bldr./Bedrock (> 36.0")					
% EMBEDDEDNESS (Ocular estimate)					
Spawning habitat (glide, pool tailout)					
Food production areas (riffle)					
Rearing/overwintering (pool)					

PEBBLE COUNT WORK TABLE: # particles by size class	1	2	3	4	5
Sand/Silt (< .1")					
Coarse fines (> .1-.25")					
Gravel (> .25-3.0")					
Rubble (> 3.0-6.0")					
Cobble (> 6.0-12.0")					
Boulder (> 12.0-36.0")					
Lg. bldr./Bedrock (> 36.0")					

CROSS SECTION COMPOSITION
(Level III)

Forest / District _____ / _____ Date _____

Drainage _____

Examiners _____ Photo No's_____

Complex _____

Location _____

_____

Transect No._____ Feet / Step_____

CT	Steps	NUMBER STEPS (Woody Ct's)						
		Sprout	Young	Mature	Decadent	Dead	Total	Feet
TOTALS								
ESTIMATED HT.								

TOTAL FEET OF RIPARIAN _____

TOTAL FEET OF NON-RIPARIAN_____

CROSS SECTION SUMMARY SHEET
(Level III)

Forest / District _____ / _____ Date Compiled _____

Drainage _____

Examiners _____

Complex _____

Transect No's_____

CT	T_1 (feet)	T_2 (feet)	T_3 (feet)	T_4 (feet)	T_5 (feet)	TOTAL	PCT COMPOSITION c.t. (feet) Total Riparian
					GRAND TOTAL		100

BARS WITHIN TRANSECT

	STEPS	FEET
GRAVEL		
SAND		
SILT / CLAY		

Total feet of shrub/tree canopy (C) _____

Total feet of transect (T) _____

$\frac{C}{T}$ = _____% cover

ECOLOGICAL STATUS PERCENT - UNDISTURBED TYPES PERCENT

STATUS (check)

_____ 0 - 15 = very early seral
_____ 16 - 40 = early seral
_____ 41 - 60 = mid seral
_____ 61 - 85 = late seral
_____ 85+ = PNC

RIPARIAN GREEN LINE TRANSECT DATA
(Level III)

Forest / District _____ / _____ Date _____

Drainage _____

Examiners_____ Photo No's_____

Complex _____

Location _____

_____

Transect No._____ Feet/Step_____

CT	STEPS Left	STEPS Right	FEET (Step x ft / Step)

BARS WITHIN TRANSECT (Optional)

	STEPS	FEET
GRAVEL		
SAND		
SILT / CLAY		

GREEN LINE SUMMARY SHEET
(Level III)

Forest / District _____ / _____ Date Compiled _____

Drainage _____

Examiners _____ Photo No's_____

Complex _____

Transect No's_____

CT	T_1 (feet)	T_2 (feet)	T_3 (feet)	T_4 (feet)	T_5 (feet)	COMPOSITION	
						Total Feet	Percent

BARS WITHIN ALL TRANSECTS (Optional)

	FEET
GRAVEL	
SAND	
SILT / CLAY	

WOODY SPECIES REGENERATION
(Level III)

Forest / District _____ / _____ Date _____

Drainage _____

Examiners_____ Photo No's_____

Complex _____

Location _____

Green Line Transect No. _____ Cross Section Transect No. _____

	Seedling / Sprout		Young / Sapling		Mature		Decadent		Dead	
Species	**Left**	**Right**	**Left**	**Right**	**Left**	**Right**	**Left**	**Right**	**Left**	**Right**
TOTAL										

WOODY SPECIES REGENERATION SUMMARY
(Level III)

Forest / District _____ / _____ Date Compiled _____

Drainage _____

Examiners _____ Photo No's_____

Complex_____

Transect No's_____

	Seedling / Sprout			Young / Sapling			Mature			Decadent			Dead			Total
Species	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	
TOTAL (ea trans)																
TOTAL (combined)																

Statement of Health and General Comments: _____

_____

_____

_____

_____

_____

Average Height:

Tree Layer(s)_____

Shrub Layer(s) _____

Herb Layer(s) _____

RIPARIAN AQUATIC DATA SHEET (Level III)
(for Complex Characterization)
(See Appendix H for instructions)

LOCATOR DATA

A. Forest: _____ B. District: _____
C. Stream: _____ D. Catalog No.:____,____,____,____,____,____,____,____,____,____,____
E. Complex Name: _____ F. Complex Number: _____
G. Complex Location: _____Range: _____Township: _____Section: _____Quad Name

SAMPLE INFORMATION

H. Survey Date (s): _____ /_____ /_____ I. Unit of Measure: _____(ft or m)
J. Estimator: _____ K. Recorder: _____
L. Measure Dimensions at every "n"th: _____Riffle: _____Glide: _____Pool: _____Side Channel
M. Measure Substrate at every "N"th: _____Riffle: _____Glide: _____Pool: _____Side Channel

COMPLEX SCALE DATA

N. Gradient: _____% O. Sinuosity:_____ P. Confinement: ____Cnf ____Mod ____UnC
Q. Discharge: _____cfs R. Flow Stage: ____BkF ____MF(r) ____MF(f) ____BsF S. Alkalinity: _____mg/l
T. Temperature/Time: _____ /_____; _____ /_____; _____ /_____; _____ /_____; _____ /_____

1. Nat Seq Ord								
2. Habitat Type & Number								
3. Pool: Position								
Type								
Feature								
4. Bankfull Width								
5. Max Bankfull Depth								
6. Bankfull Shr Depth (L)								
(R)								
7. Bankfull Channel Shape								
8. Average H.U. Length								
9. Average H.U. Width								
10. Max D @ Average Width								
11. Shr D @ Average W(L)								
(R)								
12. Wetted Channel Shp								
13. Max Pool Depth								
14. Max Pool Crst D								
15. Bank Length Veg/St								
Veg/US								
UnV/St								
UnV/US								
16. Bank Length Undercut								
GntSlp								
StpSlp								
17. Substrate % SS								
> 0.1-3" GR								
> 3-6" RB								
> 6-12" CB								
> 12-36" BL								
> 36" LB								
BD								
18. LWD # Pieces								
# Aggregations								
# Jams								
19. # Pocket Pools								

RIPARIAN AQUATIC DATA SHEET (Level III)
(for Complex Characterization)

KEY TO DATA ENTRIES

Habitat Types: Riffle (**R**): Glide (**G**); Pool (**P**); Side Channel (**S**)

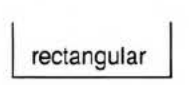
Pool Position: Mid-channel (**M**); Lateral (**L**); Off-channel (**O**) **Pool Type:** Dam (**D**); Scour (**S**)

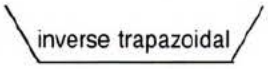
Pool Feature: Bar (**br**); Beaver (**bv**); Bedrock (**bd**); Boulder (**bl**); Culvert (**cl**); Meander/Undercut (**mn**); Root System—living (**rs**); Woody Debris—dead (**wd**); Other (**ot**)

Channel Shape Descriptors:

R = rectangular

T = triangular





Bank Shape Descriptors: Undercut banks = < 90 degree angle: Steeply Sloped banks = 90-135 degree angle; Gently Sloped banks = > 135 degree angle. (Angles refer to one formed between water surface and bank top.)

Large Woody Debris: Only consider pieces that have a portion of their length within the bankfull channel prism and have a length equal to or greater than 3/4 the average bankfull channel width. Count the number of **pieces** (acting individually), **aggregations** (2-4 pieces acting together), and **jams** (5 or more pieces acting together).

Pocket Pools: Count the number of pocket pools, with a surface area > 10 square feet (1 square meter) but not as long or wide as average stream width, that are inclusions within riffles and glides.

SUBSTRATE COMPOSITION WORK TABLE

Habitat Type & Number	Number of Particles Sampled by Substrate Size Class							
	Sand/Silt	Gravel	Rubble	Cobble	Boulder	Lg. Boulder	Bedrock	Total

Additional Comments

GREEN LINE STABILITY RATING (CTs) WORKSHEET

Complex Name: _____

(Stream, Lake, etc; Dom. Soil Family; Stream Type; Dom. c.t.)

Community Type	% Composition	STABILITY	
		Class	Index
Total	100%		

Stability Rating

_____ 0 - 2 = very poor (very low)
_____ 3 - 4 = poor (low)
_____ 5 - 6 = moderate
_____ 7 - 8 = good (high)
_____ 9 - 10 = excellent (very high)

GREEN LINE ECOLOGICAL STATUS WORKSHEET

Complex Name: _____

(Stream, Lake, etc; Dom. Soil Family; Stream Type; Dom. c.t.)

Community Type	% Composition	ECOLOGICAL RATING	
		Early	Late
Total	**100%**		

Percent Late Seral Types = _____ ÷ Potential (see capability group value) = _____

(Ecological Status)
Status (Check One)

_____ 0 - 15 = very early seral
_____ 16 - 40 = early seral
_____ 41 - 60 = mid seral
_____ 61 - 85 = late seral
_____ 86+ = PNC

Appendix B - RIPARIAN MANAGEMENT CATEGORIES AND VALUE CLASSES

APPENDIX B

Riparian Management Categories and Value Classes

1. Sawtooth National Forest

SAWTOOTH NATIONAL FOREST

RIPARIAN MANAGEMENT CATEGORIES AND VALUE CLASSES

Riparian Management categories - Riparian areas, although comprising only about 2.6 percent of the Sawtooth National Forest, are among the Forest's most productive and important habitats. Their significance to many resources is widely recognized. In order to more fully recognize and manage to protect or enhance these riparian dependent resource values, a riparian stratification system was developed for the Sawtooth NF. This stratification system recognizes five categories for riparian areas based upon: (1) Existing and potential fisheries, recreation and wildlife resource values; (2) soil productivity and water quality protection needs; and (3) the need to protect values which contributed to an area's special administrative designation, such as "wilderness." The five categories are defined as follows:

***Category I*: Highest Value Riparian Area (meets *any* of the listed criteria).**

1. Associated with a highest value fishery habitat.
2. Associated with an outstanding value recreation resource.
3. Associated with highly unstable streambeds and banks.*
4. Associated with municipal watersheds or research natural areas.

***Category II*: High Value Riparian Area (meets *any* of the listed criteria).**

1. Associated with a high value fishery habitat.
2. Associated with a substantial value recreation resource.
3. Associated with moderately unstable streambeds and banks.
4. Associated with wilderness areas, wild and scenic rivers, National recreation areas, National historic landmarks, or National natural landmarks.
5. Associated with a highest value wildlife habitat.

***Category III*: Moderate Value Riparian Area (meets *any* of the listed criteria).**

1. Associated with a moderate value fishery habitat.
2. Associated with a moderate value recreation resource.
3. Associated with moderately stable streambeds and banks.
4. Associated with a high value wildlife habitat.

Category IV: **Limited Value Riparian Area (meets *any* of the listed criteria).**

1. Associated with a limited value fishery habitat.
2. Associated with a limited value recreation resource.
3. Associated with stable streambeds and banks.
4. Associated with a moderate value wildlife habitat.

Category V: **Low Value Riparian Area (meets *all* of the listed criteria).**

1. Not classified as fishery habitat.
2. Associated with unclassified value recreation resource.
3. Associated with limited value wildlife habitat.
4. Not associated with perennial streams with a base flow greater than one cfs.
5. Not associated with special administratively designated areas.

* As inherent stream channel stability decreases, the condition of the associated riparian area becomes increasingly more important for protection of soil productivity and water quality. That is, highly unstable streambeds and banks are not characteristics desired for highest value riparian areas, but are recognized as conditions to which it is desirable to apply the most stringent standards and guidelines.

Riparian Potential - The following riparian definitions were developed for the Sawtooth NF and represent a point in vegetative development in relationship to the assumed potential of the riparian community complex.

1. Class I

Potential key herbaceous and woody species in the riparian complex are present, reproducing, and in good vigor. Cover of key species is 90 percent or greater of estimated potential. Soil productivity has not been significantly reduced, as evidenced by no more than 10 percent reduction in macropore space from estimated potential. Streambank stability is at least 90 percent of estimated potential. Fish production is at least 90 percent of estimated potential.

2. Class II

Potential key herbaceous and woody species in the riparian complex are present, reproducing, and in moderate vigor. Cover of key species is 70 to 89 percent of estimated potential. Soil productivity has not been substantially reduced, as evidenced by no more than 10 percent reduction in macropore space from estimated potential. Streambank stability is 70 to 89 percent of estimated potential.

3. Class III

Potential key woody species in the riparian complex are present, but intermingled with, and being replace by, secondary woody species. Potential key herbaceous species are present and reproducing. Herbaceous cover may be high, but that of key species is only 45 to 69 percent of estimated potential. Soil productivity has been reduced, as evidenced by an 11 to 19 percent reduction in macropore space from estimated potential. Streambank stability is 45 to 69 percent of estimated potential. Fish production is 45 to 69 percent of estimated potential.

4. Class IV

Potential key woody species in the riparian complex are absent, or present only in remnant or trace amounts, and not successfully reproducing. Potential key herbaceous species are present and reproducing at 25 to 44 percent of their estimated potential. Ground cover is 26 to 44 percent of estimated potential. Soil productivity is substantially reduced, as evidenced by a 20 percent or greater reduction in macropore space from estimated potential. Streambank stability is 26 to 44 percent of estimated potential.

5. Class V

Key herbaceous and woody species are absent, or present only in trace amounts in the riparian complex. Herbaceous cover, if present, is composed of predominantly introduced or increaser/invader species. Soil productivity has been substantially reduced as evidenced by 20 percent, or greater, reduction in macropore space from estimated potential. Streambank 25 percent, or less, of estimated potential.

Fishery Habitat Value Classification Systems - A classification system designed for the Sawtooth NF and used as one criteria in defining riparian management categories. Four fish habitat value classes are recognized.

1. *Highest Value Fishery Habitat* (meets any of the listed criteria).

   a. Supports a threatened or endangered fish species.

   b. Supports a Regional Forester designated sensitive fish species.

   c. Supports a State-designated fish species of special concern.

   d. Nationally or State-wide significant sport/commercial fishery (demand/recognition).

   e. State stream classification (1978) of "I" will quality the aquatic habitat in the absence of conflicting evidence.

2. *High Value Fishery Habitat* (meets any of the listed criteria).

   a. Supports a "pure" population of a native salmonid species.

   b. Regionally significant sport fishery (demand/recognition).

   e. State stream classification (1978) of "II" will qualify the aquatic habitat in the absence of conflicting evidence.

3. *Moderate Value Fishery Habitat* (meets any of the listed criteria).

   a. Locally significant sport fishery (demand/recognition).

   b. State stream classification (1978) of "III" will qualify the aquatic habitat in the absence of conflicting evidence.

4. *Limited Value Fishery Habitat* (meets any of the listed criteria).

   a. Limited significance as a sport fishery (limited demand/recognition - use is generally incidental to other activities).

2. Perennial streams of more than one cfs at base flow, which themselves may not provide for a sport fishery, but whose water quality directly influences another aquatic habitat which supports a sport fishery.

3. State stream classification (1978) of "IV" will qualify the aquatic habitat in the absence of conflicting evidence.

Recreation Resource Value Classification System - Descriptive narratives are based upon riparian-dependent, land-based recreational opportunities, water-based recreational opportunities, water characteristics, recreational opportunity spectrum (ROS), visual resource management (VRM), seasonal nature of use, user significance and access:

1. Outstanding Value Recreation Resource

An outstanding recreational resource may be due to a unique combination of attributes, or to one specific characteristic that creates exceptional recreational opportunities for one or more activities. Outstanding resources would be described by recreation experts and the public as "blue ribbon" resources--the epitome or classic of its type of setting an/or experience. Recreationists may be willing to travel substantial instances or endure difficult access to use these resources.

2. Substantial Value Recreational Resource

This class describes recreational resources that are highly values, but do not offer the special characteristics found in outstanding recreational resources. These may be somewhat scarce opportunities in a region due to the limited suitability of certain opportunities, or based on the special physical attributes of the river segment. These opportunities and/or settings are of a higher quality than the resources typically found in the Region. These are very important recreational settings in the Region.

3. Moderate Value Recreational Resource

Moderate recreational resources are typically available in the Region. They have considerable recreational value, but the physical setting or experience opportunity may be considered standard for what is available in the Region. It may be a valuable recreation resource in part because it is convenient or easily accessible to user groups. Most users typically would not travel a great distance to use this resource as it has some substitutability within the Region.

4. Limited Value Recreational Resource

These resources have recreational value, but relative to the other value classes do not offer as high a quality recreation context, special physical setting or the intensity or uniqueness of experience described in the other value classes. The recreational value may be limited due to the inherent nature of the setting, to restricted access, or due to man-made disvalues, such as disturbed land, polluted water, etc.

5. Unclassified Value Recreational Resource

These resources likely have some current or potential recreational value, but the level or type of value is unknown. All rivers and streams in the State having a flow of at least five cfs during the recreational use period are assumed to be in this class until they are classified or dropped from the study. This class does not imply a lack of recreational value; it states that values are as yet unknown.

Soil and Water Resource Protection Classification System - Inherent streambed and bank stability characteristics, resulting from the combination of stream gradient, sinuosity, width/depth ratio, channel materials, entrenchment, confinement, and soil/landform, are used as one criteria for delineating riparian management

categories to the extent that the standards and guidelines applied to a given riparian category are required to ensure protection of soil productivity and water quality.

1. Highly Unstable Streambeds and Banks - Stream type B4.*

2. Moderately Unstable Streambeds and Banks - Stream types B3, B5, C3, C4, D1, and D2.

3. Moderately Stable Streambeds and Banks - Stream types A4, C5.

4. Stable Streambeds and Banks - (all other stream types).

*After Rosgen (1985)

Wildlife Habitat Value Classification System - A classification system designed for the Sawtooth NF and used as one criteria in defining riparian management categories. Three wildlife habitat classes are recognized.

1. *Highest Value Wildlife Habitat* (meets any of the listed criteria).

   a. Supports a threatened or endangered wildlife species.

   b. Supports a dependent management indicator species.

   c. Supports a State-designated wildlife species or special concern.

   d. Critical inter habitat.

   e. Areas contributing to excellent vertical diversity.

2. *High Value Wildlife Habitat*

Areas contributing to excellent horizontal diversity.

3. *Moderate Value Wildlife Habitat*

Areas contributing fair to good vertical and/or horizontal diversity.

4. *Limited Value Wildlife Habitat*

Provides a source of water, little horizontal or vertical diversity.

Aquatic Habitat Condition - A condition classification prepared for the Sawtooth NF aquatic habitats that recognizes the following four conditions:

1. Excellent

Fish production is at least 90 percent of the estimated potential production capability (on the basis of geologic parent material and aquatic habitat type/stream channel type). Macroinvertebrate biotic condition index (BCI) is 90 or greater. Macroinvertebrate populations are dominated by clean water taxa. Sediment an/or organic, enrichment-tolerant taxa are represented in low numbers. Streambank stability is at least 90 percent of the estimated potential (on the basis of the inherent capability of the stream-side potential natural communities to protect the streambanks from erosive stream flows).

2. Good

Fish production is 70 to 89 percent of the estimated potential production capability. Macroinvertebrate BCI is 80 to 89. Sediment and/or organic, enrichment-tolerant taxa are present. Some clean water taxa are prevalent; however, the most sensitive taxa may be absent, or if present, are at depressed levels. Streambank stability is 70 to 89 percent of the estimated potential.

3. Fair

Fish production is 45 to 69 percent of the estimated potential production capability. Macroinvertebrate BCI is 71 to 79. Sediment and/or organic, enrichment-tolerant taxa are a prevalent component of macroinvertebrate populations. Clean water taxa are present, but at depressed numbers. Streambank stability is 45 to 69 percent of the estimated potential.

4. Poor

Fish production is 44 percent, or less, of the estimated potential production capability. Macroinvertebrate BCI is 70 or less. Macoinvertebrate populations are dominated by sediment and/or organic, enrichment-tolerant taxa. Clean water taxa are essentially absent, or represented in very low numbers. Streambank stability is likely to be 45 percent, or less, of the estimated potential.

Appendix C - STREAM FISH AND HABITAT/RIPARIAN RATING TABLES

APPENDIX C

Uinta National Forest Stream Fish Habitat/Riparian Rating Table

UINTA NATIONAL FOREST
STREAM FISH HABITAT/RIPARIAN RATING TABLE

Stream Name _____ Date _____
Stream Reach _____
Catalog No. _____ Stream Miles _____
Participants _____, _____, _____, _____
(Fish Biol.) (Range Con.) (Hydrologist) ( )

Value Rating Criteria	Value	x	Weight Factor	= Rating *
Fishery Habitat Value Class (4 - 1)	____	x	2.0	= _____
Water Use Value Class (4 - 1)	____	x	2.0	= _____
Recreation Value/Potential Class (4-0) Demand, Proximity to Population Center, Accessibility.	____	x	1.6	= _____
Wildlife Habitat Value Class (4 - 1)	____	x	1.2	= _____
Management Rating Criteria				
Aquatic Habitat Condition Class (1-4)	____	x	2.0	= _____
Current Riparian Condition (1-4)	____	x	1.8	= _____
Bank & Channel Stability (4 - 0)	____	x	1.8	= _____
Management Opportunity/Freedom/ Flexibility (Legal, admin. constraints, physical access, mgmt. plan etc.) (4 - 0)____		x	1.0	= _____
Vulnerability Rating Criteria				
Damage Sensitivity (4 - 0)	____	x	1.2	= _____
Resource Potential Criteria				
Riparian Potential (4 - 0)	____	x	1.4	= _____
Fisheries Potential (4 - 0)	____	x	1.8	= _____
			Rating Total _____ *	

* (Highest point totals represent high resource values/potential and high degree of degradation or sensitivity. Conversely lower point totals represent low resource values/potential and low degree of degradation or sensitivity)

UINTA NATIONAL FOREST

STREAM FISH HABITAT/RIPARIAN RATING TABLE (Support Data)

Stream Name _____ Date _____

Catalog No. _____

Participants _____, _____, _____, _____ ( )
(Fish Biol.) (Range Con.) (Hydrologist)

Supporting Information

Grazing Management
Class of Livestock C&H ____ S&G ____
Adequate Grazing Prescription Yes ___ No ___
Prescription Compliance Excel. ___, Good ___, Fair ___, Poor ___
Permittee Cooperation Excel. ___, Good ___, Fair ___, Poor ___

Road Impacts (0 - 4) _____ (4=heaviest)
(Degree of erosion degradation/potential in the drainage)

FS Instream Flow Recommendations A Matter of Record? Yes ___ No ___

Fisheries Survey Data Available? GAWS ____ UDWR ____ NONE ____

Other _____
_____
_____

Issue Questions

Are Land Management Changes Desired Here? Yes ___ No ___
Discussion _____
_____
_____
_____

Is There A Viable Fisheries/Watershed Project Here? Yes ___ No ___
Discussion _____
_____
_____
_____

Other _____
_____
_____
_____

Other _____

CLASSIFICATION CRITERIA

VALUE RATING CRITERIA

Fishery Habitat Value Class (4 - 1) (x2.0)

- Highest Value Fishery Habitat (4)
- Highest Value Fishery Habitat (3)
- Moderate Value Fishery Habitat (2)
- Limited Value Fishery Habitat (1)

Water Use Value Class (4 - 1) (x2.0)

- Municipal Direct Use (4)
- RNA, Wilderness, Special Areas (3)
- Irrigation Direct Use (2)
- Other (1)

Recreation Resource Value/Potential Class (4 - 0) (x1.6)

- Outstanding Value/Potential Recreation Resource (4)
- Substantial Value/Potential Recreation Resource (3)
- Moderate Value/Potential Recreation Resource (2)
- Limited Value/Potential Recreation Resource (1)
- Unclassified Value/Potential Recreation Resource (0)

Wildlife Habitat Value Class (4 - 1) (x1.2)

- Highest Value Wildlife Habitat (4)
- High Value Wildlife Habitat (3)
- Moderate Value Wildlife Habitat (2)
- Limited Value Wildlife Habitat (1)

MANAGEMENT RATING CRITERIA

Aquatic Habitat Condition Class (1 - 4) (x2.0)

- Excellent (1)
- Good (2)
- Fair (3)
- Poor (4)

Current Riparian Condition Class (1 - 4) (x1.8)

- Excellent (1)
- Good (2)
- Fair (3)
- Poor (4)

Bank & Channel Stability (% Eroding Banks) (4 - 0) (x1.8)

- 75% - 100% (4)
- 50% - 74% (3)
- 25% - 49% (2)
- 10% - 24% (1)
- 0% - 9% (0)

Management Opportunity/Freedom/Flexibility (4 - 1) (x1.0)
(Legal, admin. constr., access, mgmnt. plan etc.)

- High Management Opportunity/Flexibility (4)
- Moderate Management Opportunity/Flexibility (3)
- Limited Management Opportunity/Flexibility (2)
- No Management Opportunity/Flexibility (1)

VULNERABILITY RATING CRITERIA

Damage Sensitivity (Susceptibility to erosion & flood damage resulting from other resource activities) (4 - 0) (x1.2)

-Highly Susceptible (Banks mostly fine grained alluvium with little armor or vegetative protection) (4)

- Moderately High Susceptibility (Banks substantially fine grained alluvium with limited armor or vegetative protection) (3)

- Moderate Susceptibility (Banks partially fine grained alluvium with moderate amounts of armor or vegetative protection)(2)

- Moderate Susceptibility (Banks mostly protected by course armor or vegetative cover) (1)

- Low Susceptibility (Bedrock or large boulder armored banks or will established woody vegetative root systems anchoring banks) (0)

RESOURCE POTENTIAL CRITERIA

Riparian Potential (4 - 0) (x1.4)

- High Potential (4)

- Moderately High Potential (3)

- Moderate Potential (2)

- Moderately Low Potential (1)

- Low Potential (0)

Fisheries Potential (4 - 0) (x1.8)

- High Potential (4)

- Moderately High Potential (3)

- Moderate Potential (2)

- Moderately Low Potential (1)

- Low or No Potential (0)

Appendix D - VALLEY BOTTOM CLASSIFICATION

APPENDIX D

VALLEY BOTTOM CLASSIFICATION

VALLEY FORM:

U-Shape	1000	
V-Shape	2000	
Trough-Like	3000	
Flat Bottom	4000	
Box Canyon	5000	

VALLEY BOTTOM GRADIENT:

Very Low	< 2%	100
Low	2 - 4%	200
Moderate	> 4 - 6%	300
High	> 6 - 8%	400
Very High	8%	500

VALLEY BOTTOM WIDTH:

Very Narrow	< 10 m	10
Narrow	10 - 30 m	20
Moderate	30 - 100 m	30
Broad	100 - 300 m	40
Very Broad	> 300 m	50

VALLEY SIDE SLOPES:

Low	< 30%	1
Moderate	30 - 60%	2
Steep	> 60%	3

Appendix E - ROSGEN STREAM TYPE CLASSIFICATION

APPENDIX E

CRITERIA FOR STREAM TYPE CLASSIFICATION (Rosgen, 1985)

STREAM TYPE	GRADIENT %	SINUOSITY	W/D RATIO	DOMINANT PARTICLE SIZE OF CHANNEL MATERIALS	CHANNEL ENTRENCHMENT— VALLEY CONFINEMENT	LANDFORM FEATURE — SOILS/STABILITY
A1	4 - 10	1.0 - 1.1	10 or less	Bedrock.	Very deep/very well confined.	Deeply incised bedrock drainageway w/ steep side slopes and/or vertical rock walls.
A1-a	10+	(Criteria	same	as A1)		
A2	4 - 10	1.1 - 1.2	10 or less	Large and small boulders w/ mixed cobble.	Same.	Steep side slopes w/ predominantly stable materials.
A2-a	10+	(Criteria	same	as A2)		
A3	4 - 10	1.1 - 1.3	10 or less	Small boulders, cobble, coarse gravel.	Same.	Steep, depositional features w/ predominantly **coarse** textured soils. Debris avalanche is the predominant erosional process. Stream adjacent slopes are rejuvenated with extensive exposed mineral soil.
A3-a	10+	(Criteria	same	as A3)		
A4	4 - 10	1.2 - 1.4	10 or less	Predominantly gravel, sand, and some silts.	Same.	Steep side slopes w/ mixture of either depositional landforms with fine textured soils such as glaciofluvial or glaciolacustrine deposits or highly erodable residual soils such as grussic granite, etc. Slump-earthflow and debris avalanche are dominant erosional processes. Stream adjacent slopes are rejuvenated.
A4-a	10+	(Criteria	same	as A4)		
A5	4 - 10	1.2 - 1.4	10 or less	Silt and/or clay bed and bank materials.	Same.	Moderate to steep side slopes. Fine textured cohesive soils, slump-earthflow erosional processes dominate.
A5-a	10+	(Criteria	same	as A5)		
B1-1	1.5 - 4.0	1.3 - 1.9	10 or greater (X:15)	Bedrock bed, banks, cobble, gravel, some sand.	Shallow entrenchment. Moderate confinement.	Bedrock controlled channel with coarse textured depositional bank materials.
B1	2.5 - 4.0 (X:3.5)	1.2 - 1.3	5 - 15 (X:10)	Predominantly small boulders, very large cobble.	Moderately entrenched/well confined.	Moderately stable, coarse textured resistant soil materials. Some coarse river terraces.
B2	1.5 - 2.5 (X:2.0)	1.3 - 1.5	8 - 20 (X:14)	Large cobble mixed w/ small boulders and coarse gravel.	Moderately entrenched/moderately confined.	Coarse textured, alluvial terraces with stable, moderately steep, side slopes.
B3	1.5 - 4.0 (X:2.5)	1.3 - 1.7	8 - 20 (X:12)	Cobble bed w/ mixture of gravel and sand— some small boulders	Moderately entrenched/well confined.	Glacial outwash terraces and/or rejuvenated slopes. Unstable, moderate to steep slopes. Unconsolidated, **coarse** textured unstable banks. Depositional landforms.
B4	1.5 - 4.0 (X:2.0)	1.5 - 1.7	8 - 20 (X:10)	Very coarse gravel w/ cobble mixed sand and finer material.	Deeply entrenched/well confined.	Relatively fine river terraces. Unconsolidated **coarse to fine** depositional material. Steep side slopes. Highly unstable banks.
B5	1.5 - 4.0 (X:2.5)	1.5 - 2.0	8 - 25 (X:15)	Silt/clay.	Same.	Cohesive **fine textured soils.** Slump-earthflow erosional processes.

CRITERIA FOR STREAM TYPE CLASSIFICATION (Rosgen, 1985)

STREAM TYPE	GRADIENT %	SINUOSITY	W/D RATIO	DOMINANT PARTICLE SIZE OF CHANNEL MATERIALS	CHANNEL ENTRENCHMENT— VALLEY CONFINEMENT	LANDFORM FEATURE — SOILS/STABILITY
C1-1	1.5 or less (X:1.0)	1.5 - 2.5	10 or greater (X:30)	Bedrock bed, gravel, sand, or finer banks.	Shallow entrenchment, poorly confined.	Bedrock controlled channel with depositional fine grained bank material.
C1	1.2 - 1.5 (X:1.3)	1.5 - 2.0	10 or greater (X:18)	**Cobble** bed with mixture of small boulders and coarse gravel.	Moderately entrenched/moderately confined.	Predominantly coarse textured, stable high alluvial terraces.
C2	0.3 - 1.0 (X:0.6)	1.3 - 1.5	15 - 30 (X:20)	**Large cobble** bed w/ mixture of small boulders and coarse gravel.	Moderately entrenched/well confined.	Overfit channel, deeply incised in coarse alluvial terraces and/or depositional features.
C3	0.5 - 1.0 (X:08)	1.8 - 2.4	10 or greater (X:22)	**Gravel** bed w/ mixture of small cobble and sand.	Moderately entrenched/ slight confined.	Predominantly moderate to fine textured multiple low river terraces. Unstable banks, unconsolidated, noncohesive soils.
C4	0.1 - 0.5 (X:03)	2.5+	5 or greater (X:25)	**Sand** bed w/ mixtures of gravel and silt (no bed armor).	Moderately entrenched/slight confined.	Predominantly fine textured, alluvium with low flood terraces.
C5	0.1 or less (X:05)	2.5+	5 or greater (X:10)	**Silt/clay** w/ mixtures of medium to fine sands (no bed armor).	Moderately entrenched/slight confined.	Low, fine textured alluvial terraces, delta deposits, lacustrine, loess or other fine textured soils. Predominantly cohesive soils.
C6	0.1 or less (X:05)	2.5+	3 or greater (X:5)	**Sand bed** w/ mixture of silt and some gravel.	Deep entrenched/ slight confined.	Same as C4 except has more resistant banks.
D1	1.5 or more (X:2.5)	N/A Braided	N/A	**Cobble bed** w/ mixture of coarse gravel and sand and small boulders.	Slight entrenched/no confinement.	Glacial outwash, coarse depositional material, highly erodable. Excess sediment supply of coarse size material.
D2	1.5 or less (X:1.0)	N/A Braided	N/A	**Sand bed** w/ mixture of small to medium gravel anc silts.	Slight entrenched/no confinement.	Fine textured depositional soils, very erodable - excess of fine textured sediment.

E. Estuarian Streams (Deltas)

E1. **High Constructive** - Lobate shaped deltas with a wide, well defined delta plain and numerous distributary channels.

E2. **High Constructive** - Elongate deltas with a narrow delta plain with lateral distributary channels.

E3. **High Destructive** - Tide dominated deltas.

E4. **High Destructive** - Wave dominated deltas.

G. Glacial Streams

G1. Streams incised in glacial ice with mixture of tills involving coarse textured materials including boulders, cobble, gravels, sands, and some silt.

G2. Streams incised in glacial ice with materials of silts, clays, and some sands. Typical of glacial lacustrine deposits.

CRITERIA FOR STREAM SUB-TYPES (Rosgen, 1985)

ORGANIC DEBRIS/Channel Blockages (in Active Channel)

D-1 None

D-2 Infrequent debris, what is present consists of small, floatable organic debris.

D-3 Moderate frequency, mixture of small to medium size debris effects less than 10% of active channel area.

D-4 Numerous debris mixture of medium to large sizes - affecting up to 30% of the area of the active channel.

D-5 Debris dams of predominantly large material affecting **over** 30% to 50% of the channel area and often occupying the total width of the active channel.

D-6 Extensive, large debris dams either continuous or influencing over 50% of channel area. Forces water onto flood plain even with moderate flows. Generally presents a fish migration blockage.

D-7 Beaver dams - few and/or infrequent. Spacing allows for normal streamflow conditions between dams.

D-8 Beaver dams - frequent. Back water occurs between dams - stream flow velocities reduced between dams.

D-9 Beaver dams - abandoned where numerous dams have filled in with sediment and are causing channel adjustments of lateral migration, evulsion, and degradation, etc.

D-10 Man made structures - diversion dams, low dams, controlled by-pass channels, baffled bed configuration with gabions, etc.

RIPARIAN VEGETATION

V1 - Rock

V2 - Bare soil, little to no-vegetative cover

V3 - Annuals, forbs

V4 - Grass - perennial bunch grass

V5 - Grass - sod formers

V6 - Low brush species

V7 - High brush species

V8 - Coniferous trees

V9 - Deciduous trees

V10 - Wetlands

a. bog
b. fen
c. marsh

NOTE: Combinations of grass and brush understories with a coniferous overstory can be designated by combining sub type numbers, i.e., (V4,7,8.)

Subscript letters may be used to identify specific vegetative associations, spaciation, habitat types, or riparian types based on level of detail required by stream type user.

STREAM SIZE (S)

S-1 Bankfull width less than 1 foot.
S-2 Bankfull width 1-5.
S-3 Bankfull width 5-15.
S-4 Bankfull width 15-30.
S-5 Bankfull width 30-50.
S-6 Bankfull width 50-75.
S-7 Bankfull width 75-100.
S-8 Bankfull width 100-150.
S-9 Bankfull width 150-250.
S-10 Bankfull width 250-350.
S-11 Bankfull width 350-500.
S-12 Bankfull width 500-1,000.
S-13 Bankfull width 1,000+.

FLOW REGIMEN

General Category

E. - Ephemeral stream channels - flows only in response to precipitation.
S. - Subterranean stream channel - flows parallel to and near the surface for various seasons - a sub-surface flow which follows the stream channel bed.
I. - Intermittent stream channel - one which flows only seasonally, or sporadically. Surface sources involve springs, snow melt, artificial controls, etc.
P. - Perennial stream channels. Surface water persists year long.

Specific Category

1. Seasonal variation in streamflow dominated primarily by snowmelt runoff.
2. Seasonal variation in streamflow dominated primarily be stormflow runoff.
3. Uniform stage and associated streamflow due to spring fed condition, backwater, etc.
4. Stream flow regulated by glacial melt.
5. Regulated stream flow due to diversions, dam release, dewatering, etc.

DEPOSITIONAL FEATURES (BARS)

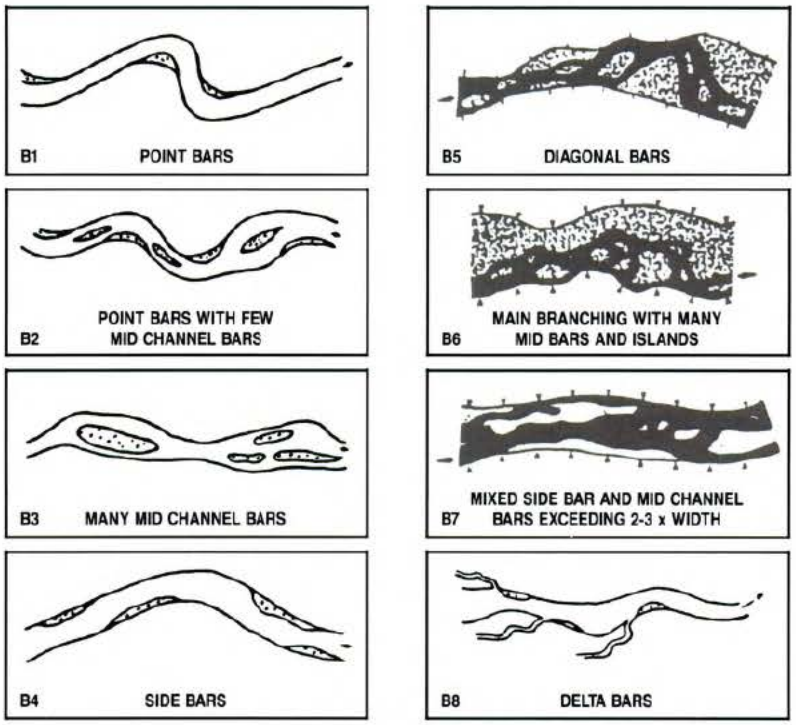
B-1 Point Bars
B-2 Point Bars with Few Mid Channel Bars
B-3 Many Mid Channel Bars
B-4 Side Bars
B-5 Diagonal Bars
B-6 Main Branching with Many Mid Bars and Islands
B-7 Mixed Side Bar and Mid Channel Bars Exceeding 2-3x Width
B-8 Delta Bars

MEANDER PATTERNS

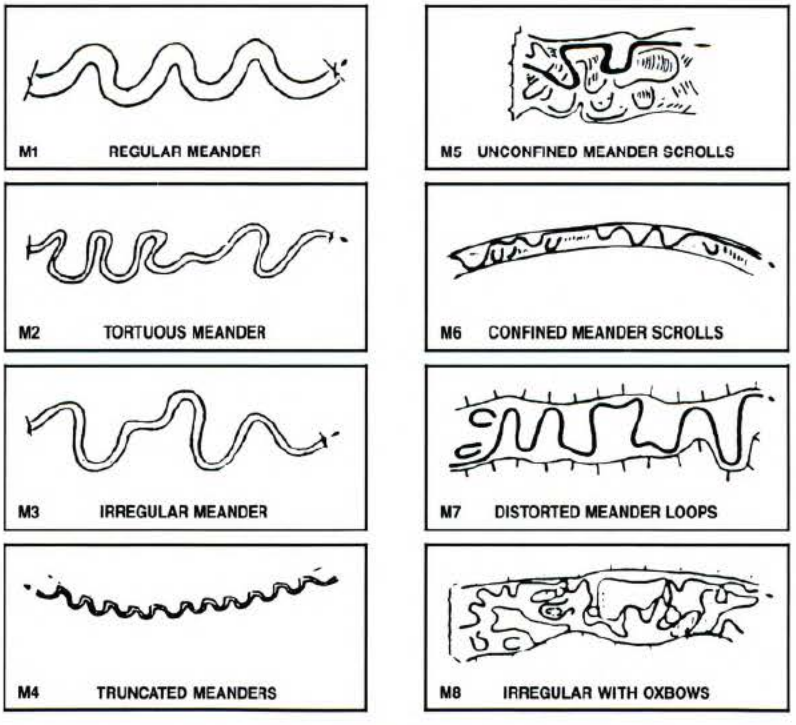
M-1 Regular Meander
M-2 Tortuous Meander
M-3 Irregular Meander
M-4 Truncated Meanders
M-5 Unconfined Meander Scrolls
M-6 Confined Meander Scrolls
M-7 Distorted Meander Loops
M-8 Irregular with Oxbows, Oxbow Cutoffs

SUB-TYPE CRITERIA DEPOSITIONAL FEATURES AND MEANDER PATTERNS
(Rosgen, 1985)

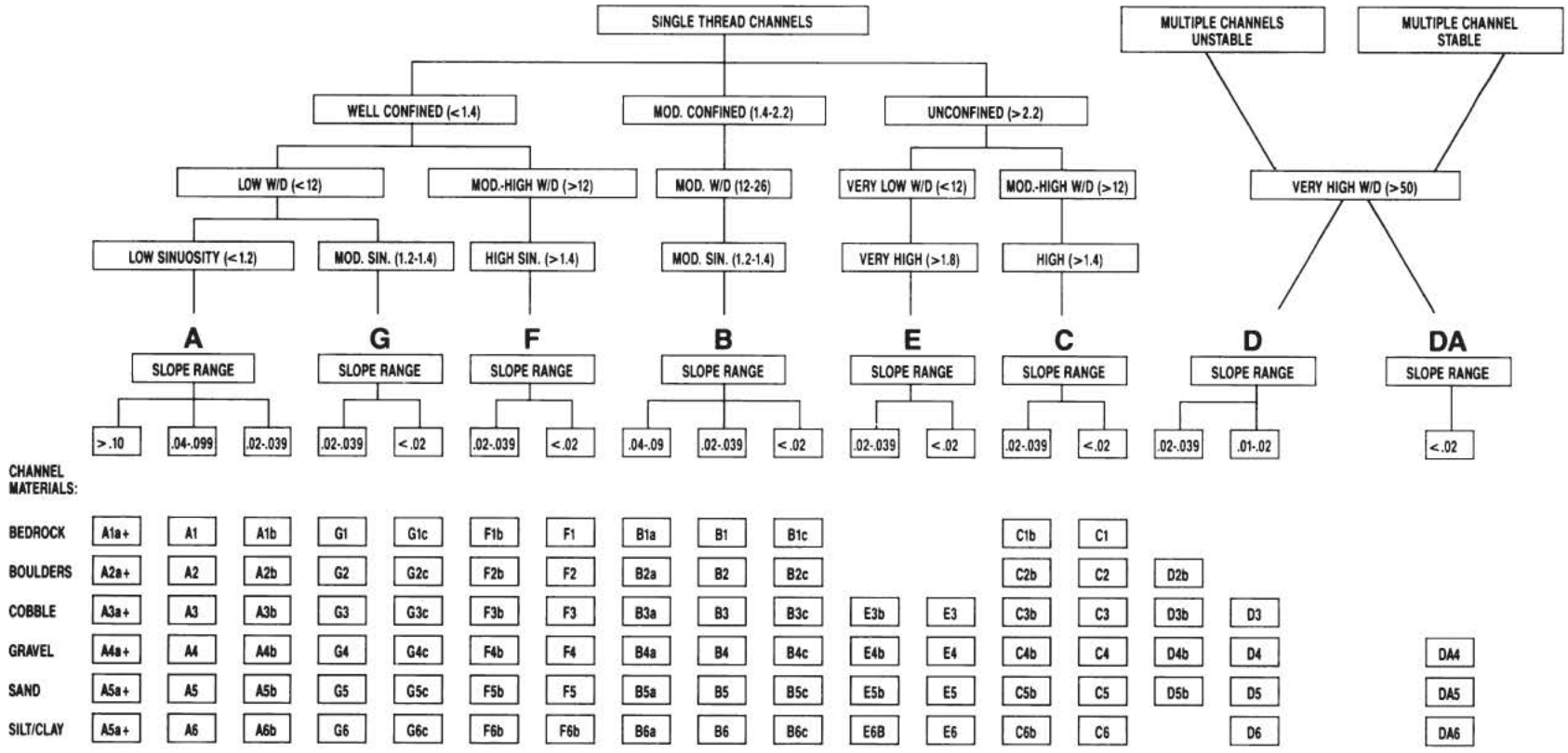
DEPOSITIONAL FEATURES (BARS)


B1 POINT BARS
B5 DIAGONAL BARS
POINT BARS WITH FEW
B2 MID CHANNEL BARS
MAIN BRANCHING WITH MANY
B6 MID BARS AND ISLANDS
B3 MANY MID CHANNEL BARS
MIXED SIDE BAR AND MID CHANNEL
B7 BARS EXCEEDING 2-3 x WIDTH
B4 SIDE BARS
B8 DELTA BARS

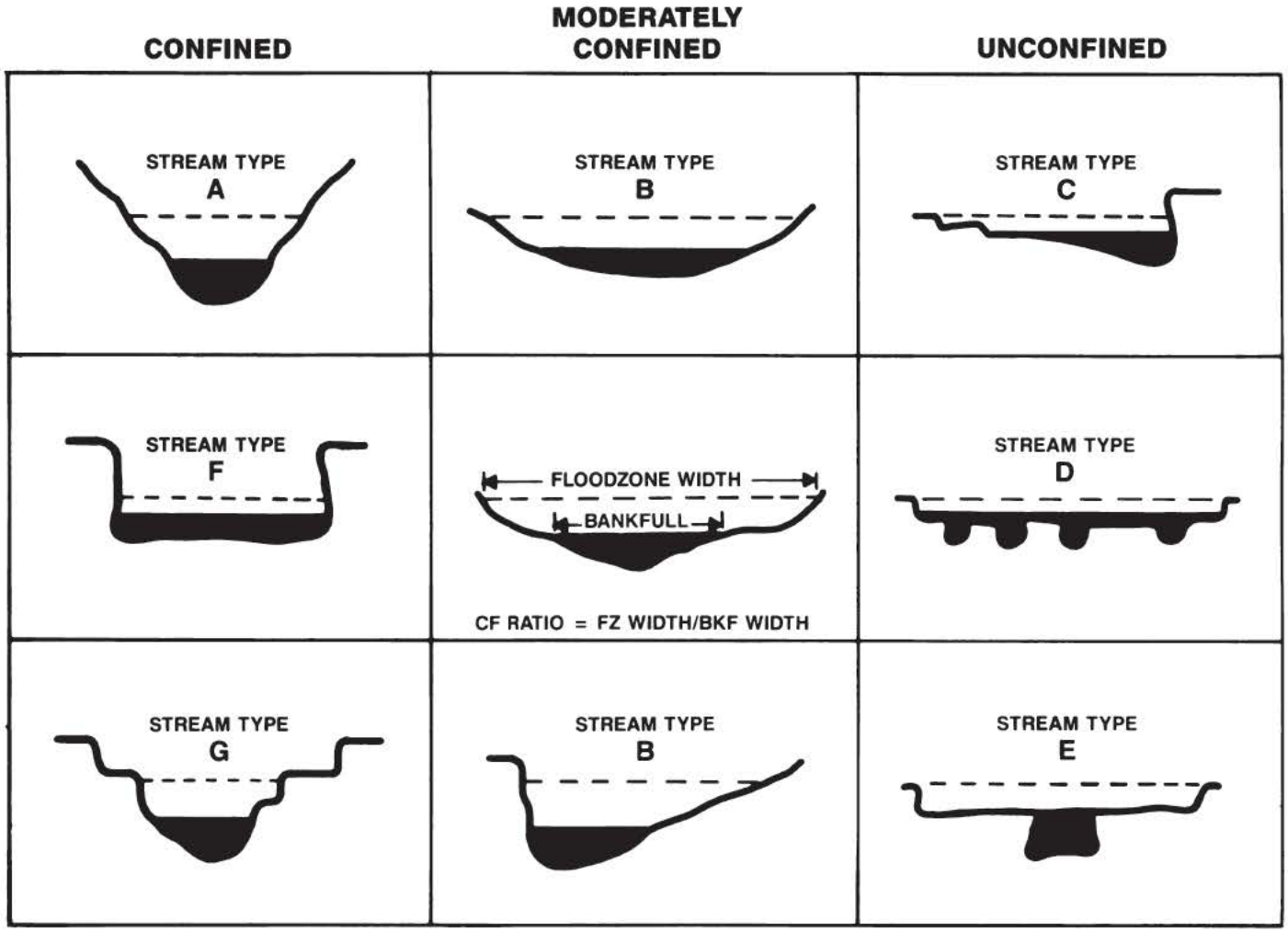
MEANDER PATTERNS



STREAM CLASSIFICATION DELINEATION KEY (Rosgen, 1991)



STREAM CONFINEMENT (Rosgen, 1991)



Floodzone area's width is determined from the elevation at 2x max. bankful depth.

Appendix F - DETERMINING BED MATERIAL PARTICLE SIZE DISTRIBUTION

APPENDIX F

DETERMINING BED MATERIAL PARTICLE SIZE DISTRIBUTION

Determining Bed Material Particle Size Distribution (Pebble Counts)

The pebble counting technique described by Wolman (1954) is used to sample coarse river bed material in wadeable streams. More sophisticated techniques must be used for larger rivers (USDI Geological Survey). Pebble count information is used in stream classification and to interpret channel stability information in relation to maintenance flow hydrographs.

Pebble count transects should be selected in the vicinity of the cross section in the same proportion as the number of pools and riffles present in the reach being inventoried. For example, if the reach is two-thirds pools, take one transect across a riffle and two across the pools. Randomly select the exact location of the transects and attempt to avoid natural tendencies to select transect locations where small size material predominate. Run enough transects to sample at least 100 particles.

At each transect, begin the count at bankfull stage on one bank and proceed to bankfull stage on the other side on step at a time with each step constituting a sampling point. Randomly select on starting point and then pick a point on the opposite bank to proceed toward. At each step, reach down to the tip of our boot and with your finer extended, pick up the first particle touched by the extended finger. Arm-pit length gloves are desirable for this in cold water conditions. Do not simply reach down and grasp a rock near the tip of your boot since this tends to bias the sample toward large-size materials. To reduce bias in sampling, look across and not down at the stream bottom when taking a step.

Each particle is tallied in one of the pebble count size classes. To determine the class, measure the intermediate diameter (in an x, y, z, coordinate system, this would be neither the longest nor the shortest side). Exact measurement is not necessary since articles are placed into classes with wide ranges. A box of various size sand and finer particles of known size is a useful reference for classifying sand and smaller size particles.

In streams with boulder and larger size materials where pacing is difficult, tape line fixed interval sampling is best. Small streams with fine materials too narrow for pacing should also be sampled by stretching a tape and sampling at fixed intervals. In small streams, the best procedure is to collect at least 200 particles in a bag and wet sieve them on site.

STREAM CHANNEL STABILITY

Item Rated	Stability Indicators by Classes							
UPPER BANKS	**EXCELLENT**		**GOOD**		**FAIR**		**POOR**	
Landform Slope	Bank slope gradient <30%.	(2)	Bank slope gradient 30-40%.	(4)	Bank slope gradient 40-60%.	(6)	Bank slope gradient 60% +.	(8)
Mass Wasting (Existing or Potential)	No evidence of past or potential for future mass wasting into channels.	(3)	Infrequent and/or very small. Mostly healed over. Low future potential.	(6)	Moderate frequency and size, with some raw spots eroded by water during high flows.	(9)	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	(12)
Debris Jam Potential (Floatable Objects)	Essentially absent from immediate channel area.	(2)	Present but mostly small twigs and limbs.	(4)	Present, volume and size are both increasing.	(6)	Moderate to heavy amounts, predominately larger sizes.	(8)
Bank Protection from Vegetation	90% + plant density. Vigor and variety suggests a deep, dense root mass.	(3)	70-90% density. Fewer plant species or lower vigor suggests a less dense or deep root mass.	(6)	50-70% density. Lower vigor and still fewer species form a somewhat shallow and discontinuous root mass.	(9)	<50% density plus fewer species and less vigor indicate poor, discontinuous, and shallow root mass.	(12)
LOWER BANKS								
Channel Capacity	Ample for present plus some increases. Peak flows contained. W/D ratio <7.	(1)	Adequate. Overbank flows rare. Width to Depth (W/D) ratio 8-15.	(2)	Barely contains present peaks. Occasional overbank floods. W/D ratio 15-25.	(3)	Inadequate. Overbank flows common. W/D ratio >25.	(4)
Bank Rock Content	65% + with large, angular boulders 12" + numerous.	(2)	40 to 65%, mostly small boulders to cobble 6-12".	(4)	20 to 40%, with most in the 3-6" diameter class.	(6)	<20% rock fragments of gravel sizes, 1-3" or less.	(8)
Obstructions Flow Deflectors Sediment Traps	Rocks, old logs firmly embedded. Flow pattern of pool and riffles stable without cutting or deposition.	(2)	Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors newer and less firm.	(4)	Moderately frequent, moderately unstable obstructions and deflectors move with high water causing bank cutting and filling of pools.	(6)	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	(8)
Cutting	Little or none evident. Infrequent raw banks less than 6" high generally.	(4)	Some, intermittently at outcurves and constrictions. Raw banks may be up to 12".	(8)	Significant. Cuts 12"-24" high. Root mat overhangs and sloughing evident.	(12)	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	(16) (16)
Deposition	Little or no enlargement of channel or point bars.	(4)	Some new increase in bar formation, most from coarse gravels.	(8)	Moderate deposition of new gravel and coarse sand on old and some new bars.	(12)	Extensive deposits of predominately fine particles. Accelerated bar development.	
BOTTOM								
Rock Angularity	Sharp edges and corners, plane surfaces roughened.	(1)	Rounded corners and edges, surfaces smooth and flat.	(2)	Corners and edges well rounded in two dimensions.	(3)	Well rounded in all dimensions, surfaces smooth.	(4)
Brightness	Surfaces dull, darkened, or stained. Generally not "bright."	(1)	Mostly dull but may have up to 35% bright surfaces.	(2)	Mixture, 50-50% dull and bright, ± 15%, i.e., 35-65%.	(3)	Predominately bright, 65% +, exposed or scoured surfaces.	(4)
Consolidation or Particle Packing	Assorted sizes tightly packed and/or overlapping.	(2)	Moderately packed with some overlapping.	(4)	Mostly a loose assortment with no apparent overlap.	(6)	No packing evident. Loose assortment, easily moved.	(8)
Bottom Size Distribution & Percent Stable Materials	No change in sizes evident. Stable materials 80-100%.	(4)	Distribution shift slight. Stable materials 50-80%.	(8)	Moderate change in sizes. Stable materials 20-50%.	(12)	Marked distribution change. Stable materials 0-20%.	(16)
Scouring and Deposition	Less than 5% of the bottom affected by scouring and deposition.	(6)	5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	(12)	30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools.	(18)	More than 50% of the bottom in a state of flux or change nearly yearlong.	(24)
Clinging Aquatic Vegetation (Moss and Algae)	Abundant. Growth largely moss like, dark green, perennial. In swift water too.	(1)	Common. Algal forms in low velocity and pool areas. Moss here too and swifter waters.	(2)	Present but spotty, mostly in backwater areas. Seasonal blooms make rocks slick.	(3)	Perennial types scarce or absent. Yellow-green, short-term bloom may be present.	(4)
	COLUMN TOTALS ►		►		►		►	

Add the values in each column for a total reach score here. (E._____+ G._____+ F._____+ P._____= _____).

Reach score of: <38 = Excellent, 39-76 = Good, 77-114 = Fair, 115+ = Poor.

Appendix G - EXAMPLE OF LEVEL II RIPARIAN EVALUATION REPORT

APPENDIX G

LEVEL II RIPARIAN EVALUATION
TROUT CREEK
Data collected: July 1987

GENERAL SETTING:

The Trout Creek drainage is located in the south-central portion of the Twin Falls Ranger District, Sawtooth National Forest. The watershed is oriented north-south. It originates on the east side of Monument Peak and continues in a southerly direction to the confluence with Goose Creek in Nevada. This report covers that portion of the drainage on the Forest, in Idaho, and is separated into the three subareas identified for Trout Creek. The locations of the subareas and complexes are shown on the attached map.

WRC Number: 17040211 NFS Watershed Code: 014

SUBAREA TROA

KEY ID: R4 FO14 D02 YR86 Subarea: TROA Complexes: TRO1 through TRO5

Complex Map Code	*Complex Name*
TRO1	Riverine; Limestone; Loamy skeletal mixed Fluventic Haploborolls; A4; ABLA/VECA
TRO2	Riverine; Limestone; Loamy skeletal mixed Fluventic Haploborolls; A3; SALU/ Mesic forb
TRO3	Riverine; Limestone; Loamy skeletal mixed Fluventic Haploborolls; A3; ABLA/ Mesic forb
TRO4	Riverine; Limestone; Loamy skeletal mixed Fluventic Haploborolls; A3; POPR
TRO5	Riverine; Limestone; Loamy skeletal mixed Fluventic Haploborolls; A3; POTR/POPR

Forest Plan Management Category: III Basis: Moderate value recreation

A. General Setting

This subarea includes the headwaters of Trout Creek on the east side of Monument Peak to the junction with an intermittent tributary from the east below Little Willow Creek. The lower boundary is approximately the culvert crossing of Forest Road 536.

B. Physical Characteristics

1. **Geology**

The Trout Creek drainage starts on marine limestone. Basalt outcrops can be seen in the drainage, but they occur as caps on the limestone.

2. **Topographic Features**

a. **Elevation: Ranges from 6180 feet to 7440 feet.**
b. **Valley bottom: Codes: 3321, 3322, 2313.**

The valley gradient in this subarea varies between three and six percent. The drainage starts in a broad trough valley with a fairly good spring. It rapidly narrows and deepens into a narrow V-shaped valley with 30 to 60 percent side slopes. The valley narrows further and the side slopes steepen to greater than 60 percent about halfway through the subarea.

Valley bottom width is narrow, rarely exceeding 50 feet except at the top and bottom of the subarea.

3. **Soils**

Loamy skeletal mixed Fluventic Haploborolls, 45 percent,
Loamy skeletal mixed frigid Fluventic Haplaquolls, 25 percent,
Loamy mixed Argic Cryaquolls, 10 percent,

This drainage originates in a broad basin with wet soils. The water table is high and lateral seeps are common. Soils in the basin do not commonly flood, but overland flows occur from water supplied from adjacent uplands.

The remainder of the subarea drainage is narrow, moderate gradient and the riparian area is long and narrow. The riparian soils are flooded for short periods during snowmelt or after intense storms. Fine gravels are frequently present, being derived through alluvial-colluvial activities from the adjacent side slopes.

4. **Stream Characteristics**

Stream types: Codes: A3, A4, B3

The stream type at the springs and through most of the reach is an A3. This is a steep gradient (>4 percent), coarse textured stream type. The channel materials are boulders, cobble, gravel and sands. The A3 type is considered relatively stable, but has unstable banks of unconsolidated depositional materials originating from active side slope processes. The stream is intermittent in the middle zones. Elsewhere, this subarea has A4 and B3 stream types. A4 is a steep gradient, fine textured, unstable type and is associated with old beaver activity in TRO1. B3 is a moderate gradient, unstable, cobble/gravel type found at the lower end of the reach where the valley widens.

5. **Vegetative Communities**

Estimated Ecological Status:

TRO1,2 & 3

Present Communities		Potential Natural Communities		Amount in Common
PICEA/VECA	60	PICEA/VECA	0	0
PICEA/GATR	0	PICEA/GATR	70	0
VECA	25	VECA	trace	trace
CANE	5	CANE	10	5
CARO	5	CARO	10	5
SALU	5	SALU	10	5

Present Green line		Potential Natural Green line		Amount in Common
VECA	80	VECA	trace	trace
CANE	trace	CANE	40	trace
CARO	10	CARO	40	10
SALU	trace	SALU	10	trace

Estimated Ecological Status:

TRO4 & 5

Present Communities		Potential Natural Communities		Amount in Common
POTR/POPR	80	POTR/POPR	0	0
POTR/SMST	0	POTR/SMST	80	0
POPR	20	POPR	trace	trace
CANE	0	CANE	10	0
SALU	trace	SALU	10	trace

Present Green line		Potential Natural Green line		Amount in Common
CANE	trace	CANE	80	trace
SALU	trace	SALU	10	trace
POPR	100	POPR	0	0

a. **Forage Trend: Stable with current management system.**

b. **Vertical Diversity: (MED), Tree\Shrub-Gram/Tree.**

c. **Riparian Size: Length: R4.0 miles; Area: 8.6 acres.**

Riparian width varies from 75 feet at the springs to 10 feet in the narrow V-shaped sections.

6. **Aquatic Characteristics**

Macroinvertebrates are found wherever stream flow occurs. Fish may occupy some of the pool habitat, moving between these pools during high water. The A channels in this subarea and intermittency of flow are the limiting factors for fish occupancy. Substrate does not appear to be embedded to where aquatic organisms are impaired. The important contribution of this subarea is mostly water quality for the lower subareas.

7. **Terrestrial Habitat**

This area contains sign of old beaver activity, but has limited potential due to high gradient and low willow/aspen composition. The narrow riparian area adds little to either vertical or horizontal diversity for other species of wildlife.

8. **Management Implications**

Desirable hydric riparian species are present in abundance along the streambanks except in TRO4-TRO5 where the channel becomes intermittent and POPR is predominant under the POTR overstory. Impacts from livestock grazing are generally low, but apparent. The ORV trail is not causing significant impacts.

Riparian Management Category III requires that 80 percent of the riparian area be vegetated with 45 percent of the species being those expected for the complex. While this subarea does not conform to these vegetation standards, the stability of the riparian area is high because of the inherent stability of the channel type and valley bottom. Desirable riparian species have been replaced in portions of the subarea, but the diversity needs of riparian-dependent wildlife are being met by the increaser species and existing cover of desirable species.

Streambanks should be at least 70 percent covered with hydric species and/or rock characteristic of the complex. This standard is probably met except for TRO4 and TRO5 where POPR is common. This is due in part to intermittent streamflow in these complexes.

Management activities are currently causing impacts to the riparian area, however, management changes are not recommended for in this subarea because needs of the riparian-dependent resources are provided.

It is the team's consensus that much of the VECA would go to a GATR, HELA or SMST, or combination of these if left undisturbed. The POPR might revert more to these forbs also.

An occasional debris fan is encountered from avalanches originating from side slopes and drainages, and the stream has some unstable banks associated with cutting through these deposits. This is characteristic of the A3 stream type. No opportunities exist for aquatic habitat improvement due to high gradients and intermittency of this stream.

The dominate soils in this subarea show slight soil compaction. The area has been grazed mostly by sheep and the amount of impact on the soil is slight to none. The basin at the head of the drainage is well vegetated and the soil is protected. The particle size in the stream channel has been influenced by old beaver activity. When the dams breached, the finer soil materials were washed downstream. This material has since been reworked by high flows. Most of the stream channel does not have a distinct streambank, due to the shape of the valley bottom and the size of the stream. The small soil materials are erosive but the flows are low and evidence of much soil movement is small.

SUBAREA TROB

KEY ID: R*4* FO*14* D*02* YR*89* Subarea: TROB Complexes: TRO5a and TRO6

Complex Map Code	*Complex Name*
TRO5a	Riverine; Limestone; Loamy skeletal frigid Fluventic Haploxerolls; B3; SALU/POPR
TRO6	Riverine; Limestone; Loamy frigid Fluventic Haplaquolls; B3; POPR

Forest Plan Management Category: III Basis: Moderate recreation value

A. General Setting:

This subarea includes that portion of Trout Creek from the Forest Road 536 crossing, downstream to Swanty Creek.

B. Physical Characteristics

1. **Geology**

This segment of Trout Creek has only the Marine Limestone Formation as the primary parent material.

2. **Topographic Features**

a. **Elevation: Ranges from 6080 feet to 6180 feet.**

b. **Valley Bottom: Codes: 4232, 2222**

The valley bottom in the first half of this subarea is slightly wider than the lower half. TRO5a is a narrow flat-bottomed valley with side slope gradients greater than 30 percent. TRO6 is a narrow, V-shaped valley with 30-60 percent side slope gradients. Valley gradients are low; approximately two percent.

Valley bottom width varies from approximately 50 feet in the narrower V-shaped section to 150-200 feet in the flat-bottomed section.

3. **Soils**

Loamy frigid Fluventic Hapoxerolls 40 percent,
Loamy frigid Fluventic Haplaquolls 35 percent,
Loamy frigid Typic Haplaquolls 10 percent,

The amount of flooded soils in this segment is influenced by the channel enti enchment of Trout Creek. Where the stream channel is shallow, flooding may occur annually. The loamy frigid Fluventic Haplaquolls soil does not flood, but remains wet from subsurface water. Newly water-deposited soils usually remain bare for a short time, revegetation usually takes place within a year or two.

4. Stream Characteristics

Stream types: Codes: B3

This subarea contains an ephemeral stream type B3. This is a 1.5-2.5 percent gradient, unstable, cobble/ gravel channel with unstable banks. The channel has been scoured by high runoff but does not flow during the summer months.

5. Vegetative Communities

Estimated Ecological Status:

TRO5a & 6

Present Communities		Potential Natural Communities		Amount in Common
SAGE/POPR	80	SAGE/CARO	60	0
POPR	20	POPR	0	0
CARO	trace	CANE	40	0
JUBA	trace	JUBA	trace	trace

Present Green line		Potential Natural Green line		Amount in Common
SAGE/POPR	20	SAGE/POPR	0	0
SAGE/CARO	0	SAGE/CARO	40	0
CARO	trace	CARO	60	trace
POPR	80	POPR	0	0

a. **Forage Trend: Stable with current management system.**

b. **Vertical Diversity: (HIGH), SHRUB\SHRUB-GRAM/SHRUB.**

c. **Riparian Size: Length: 0.84 miles; Area: 5.68 acres.**

Riparian width varies from 15 feet in the V-shaped section to 90 feet in the flat-bottomed section.

6. Aquatic Characteristics

Due to the ephemeral nature of the stream in this subarea, no year-round aquatic habitat is provided. Fish passage to upper reaches may occur during high runoff periods. No pools are present that would allow carry-over of fish between runoff periods.

7. Terrestrial Habitat

This subarea contains no sign of beaver activity. Beaver habitat is limited by low composition of willow and aspen and lack of perennial water. Limited extent of riparian does little to add to the vertical and horizontal diversity.

8. **Management Implications**

The fact there is willow present in this subarea indicates that the soils retain considerable moisture even though the stream is ephemeral. It is unlikely that management activities have reduced bank storage and caused the stream to dry. The limestone bedrock is responsible for the ephemeral channel.

Riparian Management Category III standards are applied to this subarea because of the recreation value of the area; however the ephemeral nature of the stream nullifies the standards for riparian community and green line composition.

The stream type, although ephemeral, is moderately unstable and subject to erosion. The gullies in the lower reaches reflect the instability. Healthy riparian vegetation is needed to help stabilize the stream channel. POPR adds little stream stability, but adequate water appears unavailable for most sedge communities to thrive.

The gullying in this subarea is aggravated by the headcutting in the next subarea downstream. Probably the best thing for stabilizing the channel scouring in Subarea B is to provide channel stability in Subarea C.

The inherent soil productivity is moderately high to high with these soils derived mainly from limestone. The productivity on these riparian soils ranges from 2000 to 3500 lbs/ac. These soils have a medium potential for compaction. Soil materials recently deposited during high flows are not productive until they are stabilized by willows and a finer textured alluvial soil is deposited as a cap. The gravelly alluvial soils are loose and non-cohesive. These soils are easily displaced along the streambanks by livestock activity until stabilized by vegetation. Soil compaction is not a concern for the gravels. Grazing on moist soils is a concern for continued soil productivity because of livestock trampling and displacement of soil.

SUBAREA TROC

Subarea ID: R4 FO14 D02 YR86 Subarea: TROC Complexes: TRO7 through TR12

Complex Map Code	*Complex Name*
TRO7	Riverine; Limestone; Loamy mixed frigid Fluventic Haploxerolls; B4; SADR/POPR
TRO8	Riverine; Limestone; Loamy mixed frigid Fluventic Haploxerolls; B4; SABO/SMST
TRO9	Riverine; Limestone; Loamy mixed frigid Fluventic Haploxerolls; C3; CANE
TR10	Riverine; Limestone; Loamy mixed frigid Fluventic Haploxerolls; B4; SABO/POPR
TR11	Riverine; Limestone; Loamy mixed frigid Fluventic Haploxerolls; C3; POPR
TR12	Riverine; Limestone; Loamy mixed frigid Fluventic Haploxerolls; C3; POPR

Forest Plan Management Category: II Basis: High value fishery; moderately unstable stream type

A. General Setting

This subarea extends from Swanty Creek to the Forest boundary and Nevada State Line.

B. Physical Characteristics

1. Geology

This segment of Trout Creek has only the Marine Limestone Formation as the primary parent material.

2. Topographic Features

a. **Elevation: Ranges from 5635 feet to 6080 feet.**

b. **Valley Bottom: Codes: 4232, 2222, 4141, 3142, 2122.**

The valley in this subarea is typical of the lower canyon types on the Twin Falls Ranger District and Goose Creek Drainage. The valley alternates between narrow V-shaped and narrow to broad flat-bottomed valleys dictated by the bedrock configuration. The exception is Complex TR11 which is a trough-like valley (3142) with a broad bottom (400 feet). The gradient in the wider valleys is less than one percent while in the narrow valley sections the valley gradient is between one and two percent. Side slopes are generally between 30 and 60 percent.

Valley bottom width varies widely from 50 feet to over 400 feet.

3. Soils

Loamy mixed frigid Fluventic Haploxerolls 40 percent,
Loamy mixed frigid Fluventic Haplaquolls 35 percent,
Loamy mixed frigid Typic Haplaquolls 10 percent,

The amount of flooded soils in this segment is influenced by the entrenchment of Trout Creek. Where the stream channel is shallow, flooding may be annual. The loamy mixed frigid Typic Haplaquolls soil does not flood, but remains wet from subsurface water. Newly water-deposited soils usually remain bare for a short time, revegetation usually takes place within a year or two.

4. Stream Characteristics

Stream types: Codes: B4, C3

In complex TRO7, many springs surface in and adjacent to the channel and the stream becomes perennial. The channel type changes to B4 and is highly unstable as evidenced by several headcuts and a downcut channel. Channel materials change to gravels and sands. This area was impacted heavily by a recent wet year and the materials around the springs "blew out". Past beaver activity is evident. The B4 stream type is replaced in TRO9 by the C3 type, with a gradient of 1.3 percent. The C3 type is a gravel bed stream with unstable fine textured banks. The channel flows through deposits of materials derived from headcutting upstream. The channel is very poorly defined in these deposits. Below the deposits, the channel again headcuts and remains downcut to the Forest boundary. The stream type alternates from a B4 in the narrow valley sections to C3 in the wider valley sections. Beaver activity in TR11 is currently influencing the channel in a positive way by attempting to spread the water out. If the dams hold, this will reduce the annual channel scour.

5. Vegetative Communities

Estimated Ecological Status:

TRO8, 9, & 11

Present Communities		Potential Natural Communities		Amount in Common
SAGE/CANE	30	SAGE/CANE	40	30
SABO/POPR	30	SABO/CANE	40	0
POPR	35	POPR	0	0
COSE	trace	COSE	trace	trace
SAEX	trace	SAEX	trace	trace
		CANE	15	0

Present Green line		Potential Natural Green line		Amount in Common
SAGE/CANE	20	SAGE/CANE	20	20
SABO/CANE	20	SABO/CANE	20	20
CANE	0	CANE	60	0
POPR	60	POPR	0	0

Estimated Ecological Status:

TR10

Present Communities		Potential Natural Communities		Amount in Common
SABO/POPR	40	SABO/CANE	40	0
SALU/POPR	40	SALU/CANE	40	0
COSE	20	COSE	20	20

Present Green line		Potential Natural Green line		Amount in Common
COSE	30	COSE	30	30
POPR	50	POPR	0	0
SABO/POPR	10	SABO/POPR	0	0
SABO/CANE	0	SABO/CANE	40	0
CANE	0	CANE	20	0

Estimated Ecological Status:

TR12

Present Communities		Potential Natural Communities		Amount in Common
POPR	100	POPR	0	0
		SABO/CANE	40	0
		SALU	10	0
		CANE	50	0

Present Green line		Potential Natural Green line		Amount in Common
POPR	60	POPR	0	0
CANE	0	CANE	50	0
ARTR-V/POPR	40	ARTR-V/POPR	0	0
SABO/CANE	0	SABO/CANE	40	0

a. **Forage Trend: Stable with current management system.**

b. **Vertical Diversity: (HIGH), SHRUB\SHRUB-GRAM/SHRUB.**

c. **Riparian Size: Length: 4.55 miles; Area: 122 acres.**

Riparian width varies from 35 feet in the narrow valley sections to 400 feet in the wider valley sections.

6. **Aquatic Characteristics**

Two stations were selected during the inventory process for conducting reconnaissance aquatic habitat surveys. One is located within a recently completed exclosure (1988), and the other immediately outside the exclosure. Five transects, 50 feet apart, were used for each station.

Any noticeable differences in the aquatic and riparian habitats were not expected between the two stations during this evaluation, as the exclosure had only recently been installed and recovery within it had just begun. The difference in discharge for the two stations is due to the fact that the data for each station were collected one month apart. This is an undesirable variable, but unavoidable at the time. These stations will be used for Level III monitoring of site specific changes over time.

The stream substrate is homogeneous, loose, fine to coarse gravels, and is unstable. The unconsolidated substrate in both reaches shows very little embeddedness, despite disturbed banks. The analysis showed very high spawning opportunities (95 percent, exclosure; 80 percent, outside). Rearing and pool habitat was

very poor, which is not surprising due to recent streambank disturbances. Only 10 percent of the reach within the exclosure was suitable for rearing, and five percent outside. Pool habitat made up 10 percent of the overall habitat in the exclosure and 20 percent outside. The few pools that do exist are the result of channel scour of valley materials; all pools were Class IV and V. Both stations showed a 25 percent channel stability rating. Overall habitat condition indices were 46 percent (exclosure) and 50 percent. The index for habitat vulnerability for both stations was 38 percent.

Elsewhere in the subarea, beaver are creating usable pool habitat, but inspite of these benefits the downcut, eroding stream channel provides little quality aquatic habitat.

Macroinvertebrates are present, but numbers fluctuate heavily depending on season.

7. Terrestrial Habitat

Beaver activity is common and totally dependent on the riparian communities; there is no aspen in or adjacent to the riparian area. TR10 and TR12 lack any potential for beaver due to gradient and limited extent of willow and sedge communities. The amount of willow/sedge communities greater than 30 acres in size is enough to provide high vertical diversity and quality habitat.

8. Management Implications

The B4 stream type (moderate gradient, sand/gravel channel) is one of the most unstable types in the classification. Riparian vegetation plays a major role in maintaining the delicate balance of stability for this stream type. The majority of this subarea is downcut and contains large areas of continuously eroding stream banks. Livestock grazing compounded by the downcut stream channel has eliminated much of the desired riparian communities especially in the lower portions. In TR12, virtually no desirable riparian vegetation remains. This channel is contributing tons of sediment to lower reaches off the Forest, including Goose Creek Reservoir, with every high flow. This is evidenced by the large deposits seen at the crossing of the Goose Creek Road. Management strategies need to emphasize the need to increase the amount of desirable riparian community types in the composition of this riparian area. Continual disturbance by livestock and their grazing of young sprouts prevents the stabilization of the riparian area. Soil compaction, reduced infiltration, and poor ground cover intensify flood events.

The inherent soil productivity is moderately high to high with these soils derived mainly from limestone. The productivity on these riparian soils ranges from 2000 to 3500 lbs/ac. These soils have a medium potential for compaction. The community type from TR10 to TR12 is a potentially very productive. The water table has lowered due to the entrenchment of the stream. This has caused a change in the valley bottom vegetation from a riparian community to a dryland terrestrial community. The numerous beaver ponds in the stream have helped raise the ground water table. If the beaver are successful in maintaining their ponds, the conversion of vegetative types to more desirable species will be expedited. Livestock impacts are influencing the soil productivity potential through compaction. Overland flow from snowmelt and intensive summer storms is common. The fine textured soil is very erodable unless there is a vegetative cover. The streambanks are not resistant to flowing water. The alluvial banks frequently have lenses of gravelly sands; this material is easily washed away by flowing water. When these lenses are washed out, the soil above breaks off into the stream channel.

The headcuts in this subarea will take a number of years and flow events to stabilize. Some structural treatment may be considered to reduce the amount of sediment delivered downstream. Instream aquatic habitat improvement structures have a low chance of success in this channel type due to the inherent instability of the stream bed and banks.

TRO8, TRO9 and TR11 have a high inherent capability to be productive riparian complexes. These areas would show the greatest improvement, as compared to other areas within the allotment, if a management

change were made to improve riparian-dependent resources. The improvement would be rapid where downcutting has not significantly drawn down the riparian water table. The results of improvement would be similar to those found in the exclosure in TRO9. SAGE/CARO, SABO/CARO and CARO would protect the bare soil within a growing season or two. The exclosure in TRO9 contains a strong component of these species and dramatic changes are expected to occur within the exclosure. The lower portion of this subarea does not have the same composition of desirable species because the water table has been significantly lowered. More time will be needed for this area to recover after proper management is applied.

Off-site (outside of the riparian area) water developments could be beneficial for improving this area. Every opportunity to increase livestock distribution using water developments would improve riparian conditions by providing livestock options for watering other than Trout Creek.

The current beaver habitat is of low value, even though they are present. The population cannot be expected to increase with the loss of willow regeneration and herbaceous growth caused by the annual summer and late season grazing. Under the current system of livestock grazing, beaver are in direct competition for the same forage resource for much of the year. Beaver would be of value in speeding the recovery of this riparian area by creating a perched water table, storing water for later release and trapping sediments to rebuild the stream bed. Beaver ponds provide the most valuable fish habitat in the subarea.

The potential for willow/sedge community composition in this subarea is high. Improved riparian status would provide better beaver habitat. Because of the high vertical diversity that would result, we would expect to find other riparian-dependent species present besides beaver. This has not been the case in the other two subareas.

The Level II Aquatic Habitat Inventory conducted on Trout Creek showed all indications, except for spawning, that the aquatic conditions are very poor for both stations. The current cattle grazing management has significantly degraded the quality of the aquatic stream system. The stream is able to adequately cleanse its substrate despite the sediments introduced by cattle use. It is expected the quality of aquatic habitat within the exclosure will dramatically increase in the next few years. Riparian vegetation will return with the absence of livestock use and stabilize the streambanks to where undercut banks will develop. Pools of higher quality will return once the stream channel stabilizes and contribution of woody debris increases. Consequently, rearing areas within the exclosure will increase in quality and quantity.

Additional analyses will be conducted to compare conditions within and outside the exclosure. Considerable differences in the two stations are anticipated as the reach within the exclosure recovers. The stream appears to recover very rapidly with proper management changes, as seen in the newly installed exclosure. Hopefully, improvements will also occur outside the exclosure as the AMP is updated to reflect riparian needs.

REVIEW TEAM SIGNATURES

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_____ _____

_____ _____

Appendix H - LEVEL III RIPARIAN/AQUATIC CALIBRATED OCULAR ESTIMATE SURVEY

APPENDIX H

Level III Riparian-Aquatic Calibrated Ocular Estimation Survey

INTRODUCTION

As noted in the Integrated Riparian Evaluation Guide, issues driving the Level III riparian evaluation should be used to determine the specific type of aquatic community habitat evaluation to be conducted. The calibrated ocular estimation (COE) survey approach described by Hankin and Reeves (1989) will typically be used where quantitative information on existing and potential aquatic community habitat conditions are needed.

This Appendix describes a recommended core set of habitat attributes that are useful when employing a COE survey to meet Level III complex characterization objectives. A corresponding data form is included in Appendix A. Explanation of data entries and sample protocols follows in the next section.

This Appendix also describes a set of other habitat attributes which may be appropriate to characterize a complex in a given ecological setting or to address specific monitoring or evaluation objectives. A standard protocol for evaluating each attribute is suggested.

LEVEL III RIPARIAN/AQUATIC COMPLEX CHARACTERIZATION

Data are collected on the entire length of stream within a riparian complex (and frequently for the set of complexes within a watershed). For each riparian complex, the following information should be documented to characterize the complex. Letters and numbers correspond to data entries on the Level III Riparian/Aquatic Data Sheet for Complex Characterization.

LOCATOR DATA

A. **Forest**: Use two digit numerical code for Forest, if defined, otherwise spell out the Forest name.

B. **District**: Use two digit numerical or alpha-numerical code for Ranger District, if defined, otherwise spell out the District name.

C. **Stream**: Spell out the stream name as it appears on the topographic map.

D. **Catalog Number**: Enter the Stream Catalog number per Region 4 Handbook Supplement 2609.23.

E. **Complex Name**: Enter the name of the riparian complex.

F. **Complex Number**: Enter the unique complex identification number (see instructions for Level II Integrated Riparian Evaluation Guide).

G. **Complex Location**: Identify the range, township, and section that contains the lower bound of the riparian complex being evaluated. Include the name of the quad sheet containing the lower boundary of the complex.

SAMPLE INFORMATION

H. **Survey Date(s)**: Identify the date or dates the inventory was conducted. Dates are to be entered as Month/Day/Year.

I. **Unit of Measure**: Indicate if the units of measure are reported in feet (ft) or meters (m).

J. **Estimator**: List the name of the person on the inventory team making visual estimates of dimensions.

K. **Recorder**: List the name of the person taking and recording measurements of dimensions on a sub-set of habitat units.

L. **Measure Dimensions at every "N"th: Riffle/Glide/Pool/Side Channel**: Visually estimated dimensions are calibrated using measurements of the same dimensions at a stratified random subset of habitat units. "n" equals the sample interval at which the various aquatic habitat types are measured. Measurements should be taken frequently enough so that at least 10 habitat units of each type are measured per complex. If habitat units in the stream are relatively large, a higher portion of total units will need to be measured to meet this criteria (e.g., sample 1 of every 3-5 units). If habitat units are relatively small, which is often the case in small streams with abundant structure, a smaller portion of total units will need to be measured to meet this criteria (e.g., sample 1 of every 20 units). **(NOTE: If stream length within a complex is relatively short, it may not be feasible or desirable to measure at least 10 habitat units of each type. This will pose no significant analysis problem if other complexes in the watershed are also being characterized.)** The first habitat unit to be measured (for each type) is determined randomly by the throw of a die.

M. **Measure Substrate at every "N"th: Riffle/Glide/Pool/Side Channel**: Substrate composition is measured using a pebble counting technique at a stratified random subset of habitat units. "N" equals the sample interval at which substrate composition is measured.

COMPLEX SCALE DATA

N. **Gradient**: Channel gradient is measured to the nearest 0.5 percent over one or more stream meander cycles within the complex.

O. **Sinuosity**: The ratio of stream length to valley length to the nearest 0.1, as measured over one or more stream meander cycles within the complex.

P. **Confinement**: Channel confinement is defined as the ratio of floodplain width to bankfull width. Confined (Cnf) = <1.5; Moderate/Partial (Mod) = 1.2-2.5; Unconfined (UnC) = >2.5.

Q. **Discharge**: Measure discharge at the time of survey to the nearest cubic foot per second (cfs).

R. **Flow Stage**: Select the term that best reflects the flow stage at the time of the survey. Bankfull (BkF); Mid-flow and rising (MFr); Mid-flow and falling (MFf); Base-flow (BsF).

S. **Alkalinity**: As measured (to the nearest 0.5 mg/l) in the field at the time of the survey.

T. **Temperature/Time**: Measure water temperature periodically through the day while conducting the inventory. It is desirable to take temperature measurements above each major tributary. At a minimum, temperature measurements should be taken in the morning, at mid-day, and in the late afternoon. In the blank space below the Temperature/Time entry, identify the natural sequence number of the habitat unit the measurement was taken in.

AQUATIC COMMUNITY HABITAT UNIT ATTRIBUTE DATA (CORE SET)

Aquatic habitat units are the basic sample unit of the calibrated ocular estimation survey approach. Three basic aquatic habitat unit types are recognized: "riffle," "glide," and "pool." In some instances "side channel" may be recognized as a fourth aquatic habitat unit type.

In general the COE survey approach gathers data by estimating habitat attribute values at all units and accurately measuring the same attributes at a sub-set of units to develop (via correlation analysis) a correction factor for the estimated values. Habitat attributes that are not well suited to visual estimation are measured on a sub-sample basis.

The recommended minimum set of habitat attributes includes:

1. **Natural Sequence/Order**: Each habitat unit encountered is numbered sequentially (i.e., the most downstream habitat unit in the complex is number 1, the next number 2, etc.).

2. **Habitat Type and Number**: An alpha-numeric identifier is used to indicate aquatic habitat type and number in row two. For example, if the first four habitat units encountered in the complex were a riffle, a glide, a riffle and a pool they would be designated R-1, G-1, R-2, P-1).

Three (or four) aquatic habitat types are recognized as discussed below:

a. ***Riffle (R)***: A portion of the stream where water flows swiftly over completely or partially submerged obstructions to produce surface agitation.

b. ***Glide (G)***: A portion of the stream with moderate to swift velocity and without surface agitation (i.e., displays laminar or near laminar flow patterns). Do not confuse glides with tails of pools. Pool tails upstream of the pool tail crest will be counted as part of the pool.

c. ***Pool (P)***: A portion of the stream with reduced current velocity (i.e., average velocity is generally less than 1 foot per second) and often (but not always) with water deeper than surrounding areas.

Habitat units are viewed as occupying the full water width, and must be at least as long or wide as the average water width to be counted as a distinct unit. Units that are not at least as long or wide as the average water width are lumped with the most similar adjacent habitat unit. Because of their importance to many species of salmonids three exceptions to this general rule are noted:

Off-Channel Pools: Slack water areas separated from the main channel by a sand/gravel bar, or other feature should be considered as a separate habitat unit (P) if greater than 20 square feet in size.

Pocket Pools: Pocket pools are created behind obstructions as inclusions in glide and riffle habitat units (i.e., they do not meet the minimum size criteria to be counted as a distinct unit). The number of pocket pools (greater than 10 square feet in size) should be recorded for the glide and riffle units they occur in (see item number 19).

Side Channel: At a minimum clearly indicate the habitat unit where the side channel leaves and enters the main channel. Using this "minimum approach" habitat attributes are evaluated and recorded as if the side channel is one habitat unit. If side channels are identified as a separate aquatic habitat type, code them with an "S".

If side channels are large (e.g., contain greater than 1/3 of the total flow) or of particular value to the species in the system (as they frequently are), riffle/glide/pool habitat units within the side channel should be evaluated. **Side channel habitat unit data should be entered on the data form so that it is clearly separable from the habitat units in the main channel.** Multiple side channels pose a particular data recording challenge.

3. **Pool Position/Type/Associated or Formative Feature**: Pool position, type and associated or formative feature often yields important information about channel processes, and often influences fish use.

Indicate pool position as:

- M = mid-channel
- L = lateral
- O = off-channel

Indicate pool type as:

- D = dam
- S = scour

Indicate associated/formative feature as:

- br = bar
- bv = beaver
- bd = bedrock
- bl = boulder
- cl = culvert
- mn = meander/undercut
- rs = root system (living)
- wd = woody debris (dead)
- ot = other

4-7. **Bankfull Channel Dimensions**: Local bankfull channel dimensions are measured at the sub-set of habitat units where water dimensions are measured (i.e., every "n"th unit). They are *measured at a cross section with a water width that approximates the average water width of the habitat unit*. Dimensions of interest include:

4. **Bankfull Channel Width**: (to the nearest unit of measure).
5. **Maximum Bankfull Depth:** (to the nearest 0.1 unit of measure).
6. **Bankfull Shore Depths**: (left and right to the nearest 0.1 unit of measure).
7. **Shape of the Bankfull Channel**: (item 7) should also be indicated from among:

- R = rectangular

- T = triangular

- Z = trapazoidal

inverse
-IZ = trapazodial

8-14. **Habitat Unit Water Dimensions**: Existing horizontal water dimensions are visually estimated for all habitat units and measured on a sub-set of habitat units. Horizontal dimensions of interest include:

8. **Average Habitat Unit Length**: (thalweg length to nearest unit of measure).
9. **Average Habitat Unit Width**: (to nearest unit of measure). Estimate at a specific point in the habitat unit you believe represents the average width of the habitat unit. Average measured width is determined by measuring and summing widths at points 1/4, 1/2, and 3/4 of the way along the unit length, and dividing by three.

Vertical dimensions are not readily visually estimated. For each habitat unit, *at a cross section with a water width that approximates the average water width*, use a graduated rod to quickly measure:

10. **Maximum Water Depth**: (at that cross section, to the nearest 0.1 unit of measure).
11. **Habitat Unit Shore Depths**: (left and right, at that cross-section, to the nearest 0.1 unit of measure).
12. **Shape of the Wetted Channel**: (item 12) should be indicated from among:

- R = Rectangular
- T = Triangular
- Z = Trapazodial (bankfull channel width < stream bottom width)
-IZ = Inverted Trapazoid (bankfull channel width > stream bottom width)

For all *pool units* use a graduated rod to quickly measure:

13. **Maximum Pool Depth**: (where ever it occurs in the habitat unit, to the nearest 0.1 unit of measure).
14. **Maximum Pool Crest Depth:** (to the nearest 0.1 unit of measure).

15. **Bank Length by Vegetation/Stability Class**: Length of bank (to the nearest unit of measure) by vegetation/stability class is visually estimated at all habitat units and measured at a sub-set of habitat units. In making this evaluation, view the bank as if it were composed of 1 foot/meter long pieces. A practical way of doing this is to FIRST estimate the length of streambank that is vegetated and the length that is unvegetated THEN partition those lengths between stable and unstable. Partitioning *within* vegetated/unvegetated classes is readily accomplished by estimating the length of stable or unstable, which ever is shorter; the balance of the length is the longer stability class. Both banks should be considered in making this assessment.

If collection of bank vegetation/stability data at this intensity is not needed or practical, at a minimum, measure length of bank by vegetation/stability class at the sub-set of habitat units where dimension measurements are made.

Bank vegetation/stability classes include:

- Veg/St = Vegetated/Stable
- Veg/US = Vegetated/Unstable
- UnV/St = Unvegetated/Stable
- UnV/US = Unvegetated/Unstable

Bare, or essentially bare ground is considered unvegetated. If any vegetation is present it is limited to sparse annual forbs. Streambanks that are not bare ground are considered vegetated. Bank vegetation is generally viewed at the green line (or where the green line should be). A "stable" streambank (as viewed at the steepest sloped portion of the channel between the bankfull and existing water level) shows no evidence of active erosion, breakdown, tension cracking, shearing, or slumping. An "unstable" streambank shows evidences of

active erosion and/or sloughing. Undercut banks are considered *stable* until tension fractures show on the ground surface at the back of the undercut.

16. **Bank Length by Shape Class**: Length of bank (to the nearest unit of measure) by shape class is visually estimated at all habitat units and measured at a sub-set of habitat units. In making this estimate, view the bank as if it were composed of 1 foot/meter long pieces. Both banks should be considered in making this assessment.

If collection of bank shape data at this intensity is not needed or practical, at a minimum, measure length of bank by shape class at the sub-set of habitat units where dimension measurements are made.

Bank shape classes include:

- Undrct = Undercut (<90 degree angle from water surface)
- Gntslp = Gently Sloping (>135 degree angle from water surface)
- Stpslp = Steeply Sloping (90-135 degree angle from water surface)

17. **Substrate Percent:** Substrate composition *may* be estimated at each habitat unit, but often is only measured on a subset of habitat units using a "Pebble Counting" technique. Pebbles are to be tallied by seven classes - sand/silt (SS = .1 inch or smaller); coarse fines are greater than .1, but no larger than .25; gravel (GR = greater than 0.25 inch, but no larger than 3 inches); rubble (RB = greater than 3 inches, but no larger than 6 inches); cobble (CB = greater than 6 inches, but no larger than 12 inches); boulder (BL = greater than 12 inches, but no larger than 36 inches); large boulder (LB = greater than 36 inches) includes bedrock. All dimensions refer to the intermediate axis of the particle.

Pebble counts are typically made over the width of the bankfull channel (wetted or dry). A work sheet for pebble counts is provided on the back of the survey form. Pebble count transects are typically located perpendicular to stream flow, randomly along an axis parallel to stream flow. For the purposes of this survey, transects may be located at the 1/4, 1/2, and 3/4 points of the length of the habitat unit. (Note: If substrate is being measured at the same frequency that dimension measurements are taken, these three transects correspond to the points where widths are measured.) If the channel is too narrow to secure 100 pebbles along the three transects, locate transects at the 1/5, 2/5, 3/5, 4/5 points of the length of the habitat unit, or some other suitable frequency.

18. **LWD (Large Woody Debris)**: The amount of large woody debris is estimated for each habitat unit. To be counted, some portion of the individual pieces must be within the bankfull channel prism and a piece must be at least as long as 75 percent of the average bankfull width. Large woody debris will be tallied as:

- number of pieces acting individually
- number of small aggregations (groups of 2-4 pieces)
- number of jams (groups of 5 or more pieces)

19. **Number of Pocket Pools**: Pocket pools are created behind obstructions as inclusions in glide and riffle habitat units (i.e., they do not meet the minimum size criteria to be counted as a distinct unit). The *number* of pocket pools (greater than 10 square feet/1 meter square in size) should be recorded for the glide and riffle units that have pocket pools.

COMMENTS

Use the space provided to record pertinent comments. Locatable features, such as tributary streams, road crossings, Level III riparian vegetation characterization sites, etc., should be tied to specific habitat units in the comments (this is particularly important if GIS applications of the data are anticipated). Also, include

information about sediment sources, habitat improvement opportunities, and subjective evaluations of land-use effects. Photograph numbers may be recorded in the comments, or added as a row of data following Item 19.

OPTIONAL HABITAT UNIT ATTRIBUTES

A number of other habitat attributes may be appropriate to characterize a complex in a given ecological setting or to address specific monitoring or evaluation objectives. Examples of optional attributes, recommendations for their use, and standard sample protocols are described below. Selected optional habitat attributes may be added to the data form in the rows provided below Item 19.

It should also be noted that the basic aquatic habitat unit types (i.e., pool, glide, and riffle) may be further divided into sub-types. A set of sub-types has been defined by the Pacific Southwest Region (Overton 1990).

Embeddedness (by Spawning, Rearing, Overwintering): Embeddedness measurements may be taken to assess the quality of spawning, rearing, or overwintering habitats. This requires knowledge of spawning, rearing, and overwintering habitat requirements for the specie or species being evaluated. Methods described by Skille and King (1989) are used to measure embeddedness within areas meeting the specified life history habitat requirements.

Embeddedness is a factor that has the potential to limit the productivity of aquatic ecosystems within many geologic regions. The amount of embeddedness can also be significantly influenced by land management activities. Usefulness of embeddedness measurements is somewhat limited due to high natural variability over space and time. A sophisticated (and expensive) sampling strategy is likely necessary to describe relationships between changes in embeddedness and management activities.

Interstitial Space Index (ISI): ISI, uses the same sample protocols and measurements as those described for embeddedness, but analyzes the data in a different way. ISI, has been shown to be a less variable metric than embeddedness. This technique may prove to be an effective tool for evaluating rearing and overwintering habitat quality, and land management effects.

Percent Surface Fines: Percent surface fines can be used as a quick indicator of overall salmonid rearing habitat quality (and sediment deposition). Percent surface fines are measured using a pebble count technique in riffles with gradients less than 4 percent, and at pool tail outs, immediately (within 2-3 feet) upstream of the pool crest.

Large Woody Debris Input Potential: Generally, determining large woody debris input potential involves enumeration of numbers of trees by species, size, and condition within a specified distance (e.g., average height of mature trees at the site) of the stream channel. The specified distance may vary with side slope gradient, and proximity of the side slope to the channel. Large woody debris input potential may be an important factor to consider when evaluating the effects of timber management activities or proposals.

Aquatic Vegetation Amount and Characteristics: Aquatic vegetation may be an important indicator of organic enrichment, early stream recovery processes, or be a significant cc mponent of instream cover/food production. Calibrated visual estimation techniques can be used to evaluate area of streambed or length of stream margin supporting specific types of aquatic vegetation.

Canopy Closure/Stream Shading: Loss of stream shading due to changes associated with vegetation manipulation can significantly influence stream temperature in some ecologic settings. Platts, et. al. (1983), describes a technique for quantifying canopy closure/stream shading.

Bank Stability and Morphology Characteristics by Streamside Vegetation Community Type: Streambank stability and morphologic characteristics have been shown to be of extreme importance to the productivity

of aquatic ecosystems. Bank stability and shape are readily influenced by many land use activities. Within soil types, streamside community types appear to have "inherent" capabilities to provide stability to streambanks and help determine bank shape. When bank data are collected by streamside community type, two types of management activity influences can be examined. The first level of analysis addresses how management activities may have changed "streamside" vegetative community types (and, therefore, existing bank stability potential). The second level of analysis addresses how management activities have reduced the inherent bank stabilizing ability within community types (e.g., through reduced plant vigor, etc.). Using this approach, the amount of increased bank instability attributable to land use effects may be more effectively estimated. Calibrated visual estimation, or green line pacing techniques can be used to evaluate streambank characteristics within streamside community types.

Suitable Spawning, Rearing, Overwintering Habitat Area: One approach to "limiting factors" analysis is to define habitat requirements (i.e., type and amount) by critical season and life stage and then use calibrated visual estimation techniques to quantify how much of each habitat is available. Habitat "bottlenecks" may then be apparent. It is perhaps important to note that all assumptions on types and amounts of habitat required by critical season and life stage should be thoroughly documented. It should also be noted that this technique only evaluates potential physical habitat-related limiting factors. Other factors such as water quality, food production, etc., may actually limit fisheries productivity.

Macroinvertebrate Community Characteristics: One approach to cumulative effects analysis is to look at macroinvertebrate community characteristics (e.g., species composition and relative abundance). Sampling techniques are referenced in an Intermountain Region Handbook Supplement (FSH 2609.23) and elsewhere.

Overhanging Terrestrial Vegetation: Overhanging terrestrial vegetation can be an important cover component, provide high flow streambank protection/sediment filtering, and can be an important source of energy input to the stream. Streamside vegetation composition and condition can be influenced by a number of land management uses. Calibrated visual estimation techniques can be used to quantify the length of streambank with overhanging terrestrial vegetation. These assessments are best made at the end of the growing or grazing season, whichever occurs latest. A clear definition of what constitutes "overhanging vegetation" must be made, for assessment of this metric to be repeatable. This guide suggests that to provide effective cover terrestrial vegetation must be within one foot of the water surface and hang beyond the bank at least one foot.

Green Line Non-Woody Vegetation Height: Height of non-woody vegetation (as measured at the green line) at the end of the growing or grazing season, whichever occurs last, can also be used effectively to monitor land-use management effects on riparian/aquatic resources.

Cover Area by Formative Feature: Amount and type of cover may be useful in predicting fish abundance (i.e., habitat quality). Calibrated visual estimation techniques can be used to quantify the area within habitat units with cover. Cover types may include that associated with substrate, aquatic vegetation, terrestrial vegetation, woody debris, surface turbulence, undercut banks, water depth, etc.)

Cover Complexity: Quality or complexity of cover may be as important, or more important, as cover area in influencing fish use and production. Cover complexity has generally been evaluated using "subjective" rating categories. A sample, cover complexity rating for pools is shown on the following page. It is based on habitat unit features for which data are frequently collected.

Value scores can be adjusted based on species and life history stage habitat requirements. The individual scores may be summed as an index to pool cover complexity, but should be retained and compared with fish population information from the same habitat units to gain insight to the actual value of different cover components to different species and life stages (i.e., gather the data in a way that will allow the fish to "identify" what is important). If values for individual cover components are retained, it is also possible to define the mean and expected variability of cover components within a riparian complex or ecological setting.

SAMPLE COVER COMPLEXITY RATING FOR POOL UNITS: Using this scheme, cover complexity would be reported as a 5-digit code. "Values" may be adjusted to better reflect the habitat requirements of a particular species or life stage. Individual component values may be summed to provide an index to cover complexity. The mean and associated variability of the index may be calculated for management influenced riparian complexes and compared to reference complexes. Similarly, by retaining individual values, means and standard deviations can be calculated for each cover component. Used in conjunction with habitat unit specific fish population data, inferences may be drawn about species/life history stage habitat preferences and requirements.

Percent values shown below for substrate, submerged, and overhead cover relate to percent of pool area.

COVER FEATURE	*CLASS*	*VALUE*
Max Residual Pool Depth	≤0.5'	0
	>0.5-1.5'	1
	>1.5-3.0'	2
	>3.0-6.0'	3
	>6.0'	4
Substrate Cover (i.e., associated with cobble/boulder/bedrock and/or aquatic veg.)	≤10%	0
	>10-25%	1
	>25-50%	2
	>50-75%	3
	>75%	4
Submerged Cover (i.e., organic debris within the water column)	≤10%	0
	>10-25%	1
	>25-50%	2
	>50-75%	3
	>75%	4
Overhead Cover (i.e., associated with terrestrial vegetation and/or surface turb.)	≤10%	0
	>10-25%	1
	>25-50%	2
	>50-75%	3
	>75%	4
Undercut Bank Cover (i.e.,% of pool stream bank undercut.)	≤10%	0
	>10-25%	2
	>25-50%	3
	>50%	4

Intergravel Dissolved Oxygen: Monitoring intergravel dissolved oxygen, and measuring egg to emergence survival in an artificial red has been described by Burton et. al (1989). The technique may be useful for evaluating spawning habitat quality. This technique is perhaps most appropriately applied in those geologic types which produce fine sediments that readily affect intergravel dissolved oxygen. Application of the technique will require coordination and participation of the state fish management agency.

Water Chemistry Parameters: A variety of water chemistry parameters (e.g., heavy metals, indicators of organic enrichment, toxic substances, etc.) may be important in evaluating the effects of land use activities on aquatic community habitat productive capability. In most cases, water samples will be collected and submitted to a certified lab for processing. Sampling and handling methods are generally prescribed by the processing lab.

Appendix I - STABILITY/ECOLOGICAL STATUS OF RIPARIAN COMMUNITY TYPES (GREEN LINE ONLY)

APPENDIX I

Since there often is limited information concerning which community types indicate unnatural disturbances and because it is extremely difficult to find examples of PNC situations in riparian areas, the following procedures may be used to broadly rate riparian areas as to their successional status and relative stability.

Based on percent stream gradient and substrate features (Rosgen 1985), eight capability groups have been developed. Each of these eight groups has inherent environmental similarities and, therefore, similar responses to management. An "expected" percent of late successional community types along the green line has been assigned to each of these groups. These percent values are based on the minimal amount of late successional community types that would be expected to occur when areas representing each capabiltiy group are in good health and functioning properly.

Additionally, a list has been developed of all community types known to occur on lands administered by the Intermountain Region, Forest Service (Appendix I). In this list, each community type has been assigned an "L" if they are known to occur in latter successional stages along the green line or an "E" for types known to occur in earlier stages of succession along the green line. Each community type also has been assigned a stability class ranking. This ranking ranges from "1," those types least capable of buffering the forces of moving water, to "10," those types with the highest buffering capabilities.

Percent composition of each community type from the green line measurements is used to make both the ecological status and stability ratings. The procedures are as follows:

Green Line Ecological Status -- Arrange the community type composition values into either the "Early" or "Late" columns (see example - "Green Line Ecological Status." Summarize all types that occur in the "Late" column and divide by the "expected value" for that particular capability group. Rating of ecological status is then determined by comparing this number with those assigned to each of the five status values: 0-15=very early, 16-40=early, 41-60=mid, 61-85=late, and 86+=PNC.

Green Line Stability -- The green line stability rating is calculated by multiplying the percent composition of each community type along the green line by the class rating assigned to that type. These index values are then summed and compared to the appropriate rating classes: 1-2=very low, 3-4=low, 5-6=mid, 7-8=high, and 9-10=excellent.

These ecological status and stability ratings may now be evaluated against standards set for the general area being studied and management can be adjusted if these standards are not being met.

Riparian community types (ct) of the Intermountain Region

Abbreviation	Community Type Name	Stability Class (Veg)	Ecological Status[1] (Greenline)
	Coniferous Tree-Dominated Community Types		
Conif/Acco	Conifer/Aconitum columbianum c.t.	6	E
Conif/Acru	Conifer/Actaea rubra c.t.	6	E
Conif/Beoc	Conifer/Betula occidentalis c.t.	7	L
Conif/Caca	Conifer/Calamagrostis canadensis c.t.	8	L
Conif/Cose	Conifer/Cornus sericea c.t.	8	L
Conif/Dece	Conifer/Deschampsia cespitosa c.t.	5	E
Conif/Elgl	Conifer/Elymus glaucus c.t.	6	E
Conif/Eqar	Conifer/Equisetum arvense c.t.	7	L
Conif/MF	Conifer/Mesic Forb c.t.	6	E/L[2]
Conif/Pofr	Conifer/Potentilla fruticosa c.t.	6	E
Conif/Popr	Conifer/Poa pratensis c.t.	4	E
Conif/Rowo	Conifer/Rosa woodsii c.t.	6	E
Conif/TF	Conifer/Tall Forb c.t.	6	E
Picea/Caca	Picea/Calamagrostis canadensis c.t.	8	L
Picea/Cost	Picea/Cornus stolonifera c.t.	8	L
Picea/Begl	Picea/Betula glandulosa communities	10	L
Picea/Eqar	Picea/Equisetum arvense c.t.	7	L
Picea/Gatr	Picea/Galium triflorum c.t.	6	E
Pico/Casc	Pinus contorta/Carex scopulorum c.t.	8	L
	Tall Deciduous Tree-Dominated Community Types		
Acne/Cose	Acer negundo/Cornus sericea c.t.	8	L
Acne/Eqar	Acer negundo/Equisetum arvense c.t.	7	E
Poan/Beoc	Populus angustifolia/Betula occidentalis c.t.	7	L
Poan/Cose	Populus angustifolia/Cornus sericea c.t.	8	L
Poan/Cost	Populus angustifolia/Cornus stolonifera c.t.	8	L
Poan/Popr	Populus angustifolia/Poa pratensis c.t.	5	E
Poan/Rhar	Populus angustifolia/Rhus aromatica c.t.	6	E
Poan/Rowo	Populus angustifolia/Rosa woodsii c.t.	6	E
Popul/Bar	Populus/Bar c.t.	5	E
Popul/Beoc	Populus/Betula occidentalis c.t.	7	L
Popul/Cose	Populus/Cornus sericea c.t.	8	L
Popul/Rhar	Populus/Rhus aromatica c.t.	6	E
Popul/Rowo	Populus/Rosa woodsii c.t.	6	E
Popul/Salix	Populus/Salix c.t.	8	L
Potr/Beoc	Populus tremuloides/Betula occidentalis c.t.	7	L
Potr/Cose	Populus tremuloides/Cornus sericea c.t.	8	L
Potr/DG	Populus tremuloides/Dry Graminoid c.t.	6	E
Potr/MF	Populus tremuloides/Mesic Forb c.t.	6-8	E/L[2]
Potr/Rowo	Populus tremuloides/Rosa woodsii c.t.	6	E
Potr/Salix	Populus tremuloides/Salix c.t.	8	L

Riparian community types (ct) of the Intermountain Region (cont.)

Abbreviation	Community Type Name	Stability Class (Veg)	Ecological Status[1] (Greenline)
	Low Deciduous Tree-Dominated Community Types		
Alin/Bench	Alnus incana/Bench c.t.	6	E
Alin/Cose	Alnus incana/Cornus sericea c.t.	8	L
Alin/Eqar	Alnus incana/Equisetum arvense c.t.	7	E
Alin/MF	Alnus incana/Mesic Forb c.t.	6-8	E/L[2]
Alin/MG	Alnus incana/Mesic Graminoid c.t.	6-8	E/L[3]
Alin/Rihu	Alnus incana/Ribes hudsonium c.t.	7	L
Beoc/Bench	Betula occidentalis/Bench c.t.	6	E
Beoc/Cose	Betula occidentalis/Cornus sericea c.t.	8	L
Beoc/Equis	Betula occidtnatlis/Equisetum c.t.	7	E
Beoc/MF	Betula occidentalis/Mesic Forb c.t.	6-8	E/L[2]
Beoc/MG	Betula occidentalis/Mesic Graminoid c.t.	6-8	E/L[3]
	Nonwillow Shrub-Dominated Community Types		
Arca/Dece	Artemisia cana/Deschampsia cespitosa c.t.	4	E
Arca/DG	Artemisia cana/Dry graminoid c.t.	4	E
Arca/Feid	Artemisia cana/Festuca idahoensis c.t.	4	E
Arca/Feov	Artemisia cana/Festuca ovina c.t.	4	E
Arca/MG	Artemisia cana/Mesic Graminoid c.t.	4-6	E/L[3]
Arca/Popr	Artemisia cana/Poa pratensis c.t.	4	E
Artrt/Rowo	Artemisia tridentata tridentata/Rosa woodsii c.t.	4	E
Cose	Cornus sericea c.t.	7	L
Cose-Salix	Cornus sericea-Salix c.t.	8	L
Cose/Gatr	Cornus sericea/Galium triflorum c.t.	7	L
Cose/Hela	Cornus sericea/Heracleum lanatum c.t.	7	L
Pofr/Dece	Potentilla fruticosa/Deschampsia cespitosa c.t.	5	E
Pofr/Feid	Potentilla fruticosa/Festuca idahoensis c.t.	5	E
Pofr/Ligr	Potentilla fruticosa/Ligusticum grayii c.t.	5	E
Pofr/Popr	Potentilla fruticosa/Poa pratensis c.t.	5	E
Prvi/Rowo	Prunus virginiana/Rosa woodsii c.t.	6	E
Rhal	Rhamnus alnifolia c.t.	8	E
Rowo	Rosa woodsii c.t.	5	E
	Low Willow-Dominated Community Types		
Low Salix/MF	Low Salix/Mesic Forb c.t.	6-8	E/L[2]
Saea	Salix eastwoodiae c.t.	8	L
Saea/Casc	Salix eastwoodiae/Carex scopulorum c.t.	9	L
Saor/Dece	Salix orestera/Deschampsia cespitosa c.t.	7	E
Saor/TF	Salix orestera/Tall Forb c.t.	7	E
Sapl	Salix planifolia c.t.	8	L
Sapl/Caaq	Salix planifolia/Carex aquatilis c.t.	9	L
Sapl/Caca	Salix planifolia/Calamagrostis canadensis c.t.	9	L

Riparian community types (ct) of the Intermountain Region (cont.)

Abbreviation	Community Type Name	Stability Class (Veg)	Ecological Status[1] (Greenline)
Sapl/Casc	Salix planifolia/Carex scopulorum c.t.	9	L
Sapl/Dece	Salix planifolia/Deschampsia cespitosa c.t.	7	E
Sawo/Caaq	Salix wolfii/Carex aquatilis c.t.	9	L
Sawo/Caro	Salix wolfii/Carex rostrata c.t.	9	L
Sawo/Casc	Salix wolfii/Carex scopulorum c.t.	9	L
Sawo/Dece	Salix wolfii/Deschampsia cespitosa c.t.	6	E
Sawo/MF	Salix wolfii/Mesic Forb c.t.	6-8	E/L[2]
	Tall Willow-Dominated Community Types		
Sabe/MG	Salix bebbiana/Mesic Graminoid c.t.	6-10	E/L[3]
Sabo/Caaq	Salix boothii/Carex aquatilis c.t.	10	L
Sabo/Caca	Salix boothii/Calamagrostis canadensis c.t.	10	L
Sabo/Cane	Salix boothii/Carex nebrascensis c.t.	10	L
Sabo/Caro	Salix boothii/Carex rostrata c.t.	10	L
Sabo/Eqar	Salix boothii/Equisetum arvense c.t.	7	E
Sabo/MF	Salix boothii/Mesic Forb c.t.	6-8	E/L[2]
Sabo/MG	Salix boothii/Mesic Graminoid c.t.	6-10	E/L[3]
Sabo/Popa	Salix boothii/Poa palustris c.t.	6	E
Sabo/Popr	Salix boothii/Poa pratensis c.t.	6	E
Sabo/Smst	Salix boothii/Smilacina stellata c.t.	7	L
Sadr	Salix drummondiana c.t.	6	L
Saex/Barren	Salix exigua/Barren c.t.	5	E
Saex/Bench	Salix exigua/Bench c.t.	5	E
Saex/Eqar	Salix exigua/Equisetum arvense c.t.	7	E
Saex/MF	Salix exigua/Mesic Forb c.t.	6-8	E/L[2]
Saex/MG	Salix exigua/Mesic Graminoid c.t.	6-10	E/L[3]
Saex/Popr	Salix exigua/Poa pratensis c.t.	6	E
Saex/Rowo	Salix exigua/Rosa woodsii c.t.	8	E
Sage/Caaq	Salix geyeriana/Carex aquatilis c.t.	10	L
Sage/Caca	Salix geyeriana/Calamagrostis canadensis c.t.	9	L
Sage/Caro	Salix geyeriana/Carex rostrata c.t.	10	L
Sage/Dece	Salix geyeriana/Deschampsia cespitosa c.t.	5	E
Sage/MF	Salix geyeriana/Mesic Forb c.t.	6-8	E/L[2]
Sage/MG	Salix geyeriana/Mesic Graminoid c.t.	6-10	E/L[3]
Sage/Popa	Salix geyeriana/Poa palustris c.t.	6	E
Sage/Popr	Salix geyeriana/Poa pratensis c.t.	6	E
Sala1/Bench	Salix lasiandra/Bench c.t.	5	E
Sala1/MF	Salix lasiandra/Mesic Forb c.t.	6-8	E/L[2]
Sale/Bench	Salix lemmonii/Bench c.t.	6	E
Sale/Casc	Salix lemmonii/Carex scopulorum c.t.	10	L
Sale/Caaq	Salix lemmonii/Carex aquatilis communities	10	L
Sale/MF	Salix lemmonii/Mesic Forb c.t.	6-8	E/L[2]
Sale/MG	Salix lemmonii/Mesic Graminoid c.t.	6-10	E/L[3]

Riparian community types (ct) of the Intermountain Region (cont.)

Abbreviation	Community Type Name	Stability Class (Veg)	Ecological Status[1] (Greenline)
Sale/Seep	Salix lemmonii/Seep c.t.	7	L
Sale/TF	Salix lemmonii/Tall Forb c.t.	7	E
Sala2/Barren	Salix lasiolepis/Barren c.t.	5	E
Sala2/Bench	Salix lasiolepis/Bench c.t.	5	E
Sala2/Rowo	Salix lasiolepis/Rosa woodsii c.t.	7	E
Salu	Salix lutea c.t.	5	L
Salu/Bench	Salix lutea/Bench c.t.	5	E
Salu/MF	Salix lutea/Mesic Forb c.t.	6-10	E/L[2]
Salu/MG	Salix lutea/Mesic Graminoid c.t.	6-10	E/L[3]
Salu/Popr	Salix lutea/Poa pratensis c.t.	6	E
Salix/Rowo	Salix/Rosa woodsii c.t.	7	E
Salix/Caro	Salix/Carex rostrata c.t.	10	L
Salix/MF	Salix/Mesic Forb c.t.	6-8	E/L[2]
Salix/MG	Salix/Mesic Graminoid c.t.	6-10	E/L[3]
Salix/Popr	Salix/Poa pratensis c.t.	6	E
Salix/Rowo	Salix/Rosa woodsii c.t.	7	E
Salix/TF	Salix/Tall Forb c.t.	7	E
	Forb-Dominated Community Types		
Anki	Angelica kingii communities	5	E
Asch	Aster chilensis communities	4	E
Asin-Dain	Aster integrifolius-Danthonia intermedia communities	3	E
Asin-Dece	Aster integrifolius-Deschampsia cespitosa communities	3	E
Asin-Feid	Aster integrifolius-Festuca idahoensis communities	3	E
Cale	Caltha leptosepala c.t.	8	E
Carda	Cardamine spp. communities	6	E/L[4]
Ciar	Cirsium arvense communities	5	E
Doje	Dodecatheon jeffreyi c.t.	4	E
Eqar	Equisetum arvense communities	5	E
Equis	Equisetum spp. communities	8	L
Irmi/DG	Iris missouriensis/Dry Graminoid c.t.	6	E
Irmi/MG	Iris missouriensis/Mesic Graminoid c.t.	6-8	E
Lupo-Setr	Lupinus polyphyllus-Senecio triangularis c.t.	5	E
Mear	Mentha arvensis communities	5	E
Meci	Mertensia ciliata c.t.	7	L
MFM	Mesic Forb Meadow c.t.	4-6	E
Migu	Mimulus guttatus communities	3	E/L[4]
Naof	Nasturtium officinale [Rorippa nasturtium-aquaticum] communities	6	E/L[4]
Raaq	Ranunculus aquatilis communities	6	E/L[4]
Tyla	Typha latifolia c.t.	9	L
Urdi	Urtica dioica communities	6	E
Veam	Veronica americana	4	E/L[4]
Veca	Veratrum californicum c.t.	6	E

Riparian community types (ct) of the Intermountain Region (cont)

Abbreviation	Community Type Name	Stability Class (Veg)	Ecological Status[1] (Greenline)
	Graminoid-Dominated Community Types		
Agsc	Agrostis scabra communities	1	E
Agst	Agrostis stolonifera c.t.	3	E
Alaq	Alopecurus aequalis communities	3	E/L[4]
Alge	Alopecurus geniculatus communities	3	E/L[4]
Caca	Calamagrostis canadensis c.t.	8	L
Cane2	Calamagrostis neglecta [C. stricta] communities	7	L
Caaq	Carex aquatilis c.t.	9	L
Caaq2	Catabrosia aquatica communities	3	E/L[4]
Cabu	Carex buxbaumii c.t.	8	L
Cado	Carex douglasii c.t.	4	E
Cala1	Carex lasiocarpa c.t.	8	L
Cala2	Carex lanuginosa c.t.	9	L
Cale	Carex lenticularis	4	E
Cali	Carex limosa c.t.	8	L
Cami	Carex microptera c.t.	5	E
Cane	Carex nebrascensis c.t.	9	L
Caro	Carex rostrata c.t.	9	L
Casa	Carex saxatilis c.t.	8	L
Casc	Carex scopulorum c.t.	9	L
Casi	Carex simulata c.t.	8	E
Dain	Danthonia intermedia c.t.	3	E
Dece	Deschampsia cespitosa c.t.	4	E
Dece-Cane	Deschampsia cespitosa-Carex nebrascensis c.t.	7	L
Elpa1	Eleocharis palustris c.t.	6	E
Elpa2	Eleocharis pauciflora c.t.	5	E
Glyce	Glyceria spp. communities	6	E
Hobr	Hordeum brachyantherum c.t.	3	E
Juba	Juncus balticus c.t.	9	L
Juen	Juncus ensifolius communities	7	L
Muan	Muhlenbergia andina communities	3	E
Muri	Muhlenbergia richardsonis communities	3	E
Phar	Phalaris arundinacea communities	8	L
Phma (Phau)	Pragmites communis (P. australis) communities	8	L
Pone	Poa nevadensis c.t.	3	E
Popr	Poa pratensis c.t.	3	E
Scmi	Scirpus microcarpus communities	8	L
	Nonvegetated types		
Barren	Barren	1	E
Rock	Anchored Rock	10	L
Log	Anchored Log	10	L

[1] "L" designation has been assigned to those community types which have been found to be present in late successional stages along the greenline and "E" in types found in early successional stages along the greenline.

[2] These types are considered late seral only if the following Mesic Forbs dominate the undergrowth (at least 20 percent cover):

Angelica kingii	*Conium maculatum*
Equisetum spp.	*Mertensia ciliata*
Saxifraga odontoloma	*Urtica dioica*

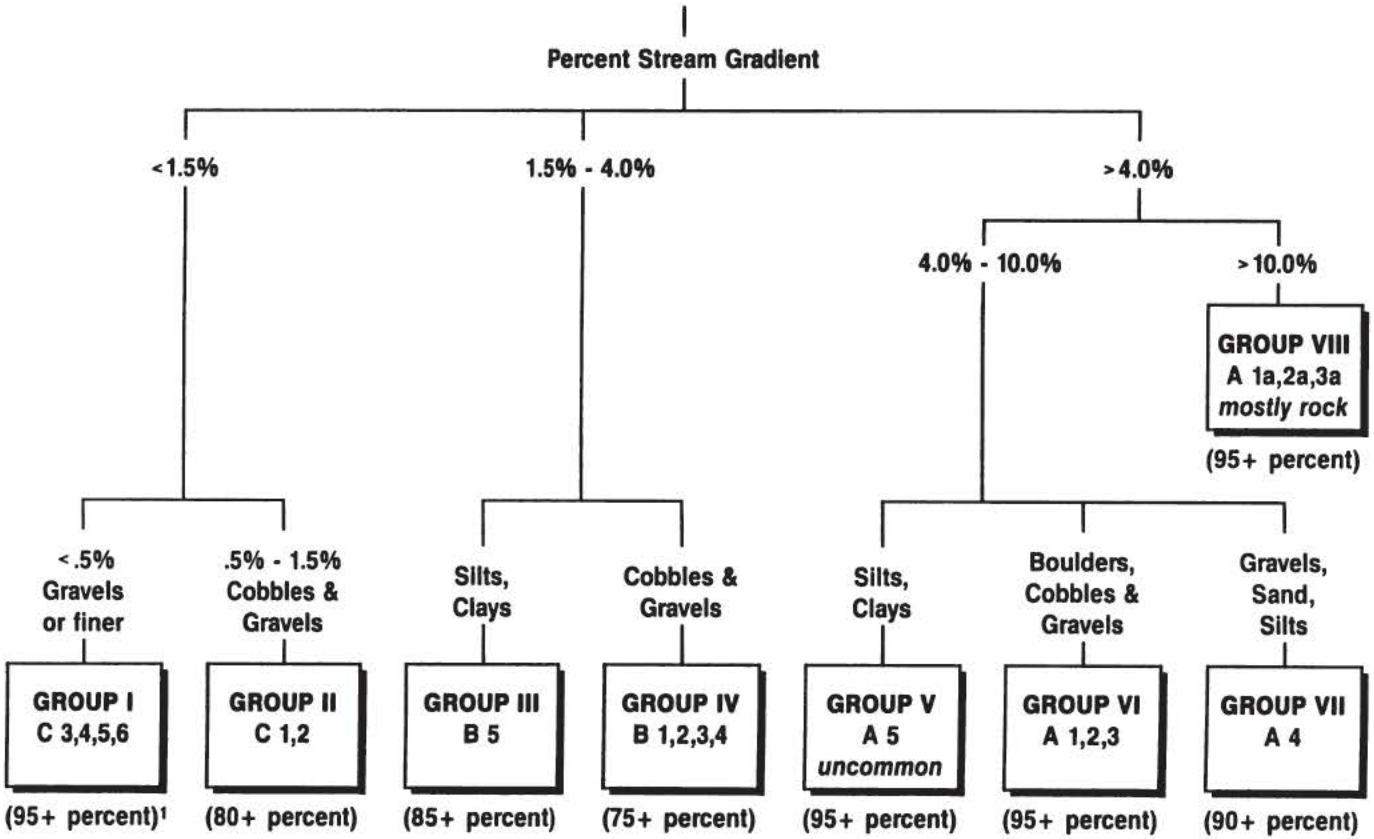
[3] These types are considered late seral only if the following Mesic Graminoids dominate the undergrowth (at least 25 percent cover):

Carex lanuginosa	*Carex nebrascensis*
Juncus balticus	

[4] These types are considered late seral only when they occur in settings where the adjacent community types are rated "Late".

KEY TO GREEN LINE RIPARIAN CAPABILITY GROUPS

(Percent gradient and substrate classes based on Rosgen, 1985)



[1] These values refer to percent of the green line that should be represented by late seral community types when riparian areas fitting this capability group are in good health and functioning properly.

EXAMPLE: Green Line Stability Rating

Green line	Composition	Stability (Class)	Stability (Index)
Popr	(70)	3	2.10
Caro	(10)	9	.90
Sabo/Popr	(03)	6	.18
Sabo/MF	02	6	.12
Raaq	05	4	.20
Caaq[2]	05	3	.15
Rock	02	9	.18
Agst	03	3	.09
	(100%)		3.92

Stability Rating

0 - 2 = Very Poor (very low)

3 - 4 = Poor (low) ◄——► 3.92 = Poor (low)

5 - 6 = Moderate

7 - 8 = Good (high)

9 - 10 = Excellent (very high)

EXAMPLE: Green Line Ecological Status

Area: Willow Creek, Strawberry area on Uinta N.F., 7,000 feet, 2.5% gradient, cobble/gravel

Green line	Composition	Ecological Status (Early)	Ecological Status (Late)
Popr	70	70	
Caro	10		10
Sabo/Popr	03	03	
Sabo/MF	02		02
Raaq	05	05	
Caaq²	05	05	
Rock	02		02
Agst	03	03	
	100%	86	14

Ecological Status	
0 - 15	= Very Early
16 - 40	= Early
41 - 60	= Mid
61 - 85	= Late
86 +	= PNC

$\frac{14}{75^*}$ = 19% = Early

*from Capability Group

Appendix J - FIELD EQUIPMENT NEEDED

APPENDIX J

Field Equipment Needed for Level II

Aquatic Thermometer

Boots (Jungle or Rubber)

Calculator (Solar-Powered)

Camera (35mm) and Film

Chalk Board (12 x 12) and Chalk

Clinometer (for side slope gradient)

Compass

Fisheries Level II Definition Sheet

Level II Field Forms

Riparian Community Type Guides

Scratch Paper

Rosgen Stream Type Classification

Stop Watch (to measure flow)

Shovel or Tile Spade

Tape -- 100 foot

Tape 12 foot (to measure flow)

Valley Bottom Classification

Topographic Map, USGS quad

Field Equipment Needed for Level III

(Will vary by the types of measurements being taken because Level III is issue driven)

Level III Field Forms

Cross-Section Composition Vegetation	5 per complex
Woody Species Regeneration	3 per complex
Green Line Vegetation Composition	3 per complex
Embeddedness (Burns' Method)	1 per complex
Region 1 Stream Channel Stability	1 per complex
Pool Classification Description	1 per complex
Stream Profile Cross-Section	3 per complex

Six foot staff for wood regeneration transect
Pace Counter (Tally Wacker) to aid with green line transect
Reference stakes for cross-section
Flagging to aid with cross-section pacing
Level and tripod/rod/rod level
Two 100 to 150 foot tapes (to measure reach length and width)
Yardstick or metal tape measure to determine water depth
Riparian community type guides
35mm camera and film
Chalk board (12 x 12) and chalk
Aerial photo for recording cross-section locations
Chaining pins
Compass
Clear metric rulers for pebble counts and embeddedness measurements
Serber Sampler for macroinvertebrates
White pan for counting macroinvertebrates
Stop watch to measure flow
60cm hoop for embeddedness measurements (Burn's method)
Pocket calculator
Aquatic thermometer
Aquatic invertebrate key
Chest waders (embeddedness and macroinvertebrate work)
Hip waders
Soil profile description forms
Shovel or tile spade
Munsell color book
Trowel or knife
Steel tape (12 foot)
Ph kit or instrument
Magnifying hand lens
Water bottle
Wire hoop (0.96 dia)
Soil thermometer
Small pail to remove water from pit (optional)
Hand towel (optional)
Soil collection bags (optional)
Equipment for soil compaction (optional)

Soil Taxonomy book
Forest soil legend
Writing equipment
Diluted HCL (optional)
Golf tees to make horizon thicknesses (optional)
Sieve; 3 inch diameter
Clinometer
Boots (jungle or rubber)
Probe